MASTER'S THESIS

Knowledge Uptake from Lived Experience to Complement Scientific Knowledge in Urban Policymaking regarding Sustainable Water Management

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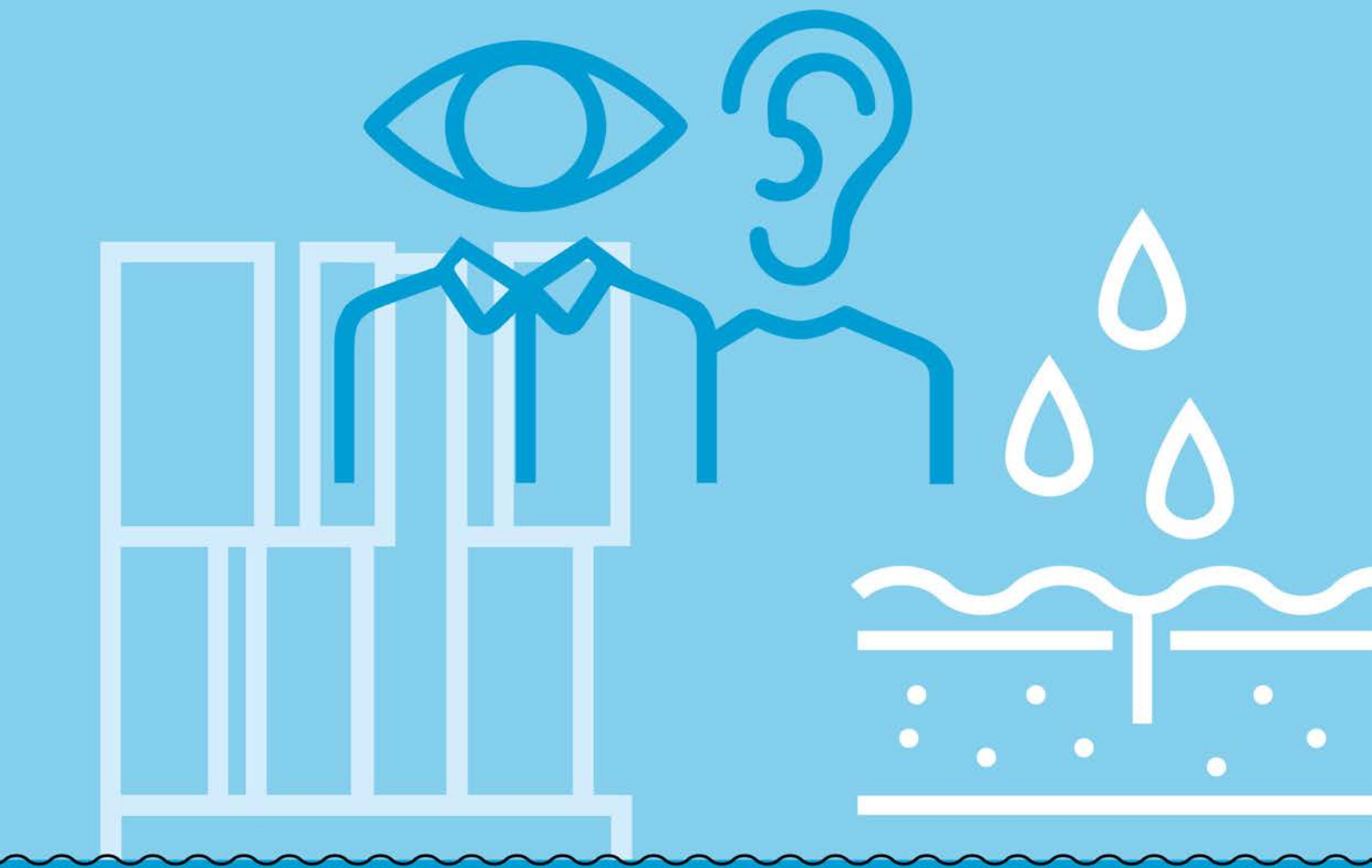
KNOWLEDGE UPTAKE FROM LIVED EXPERIENCE TO COMPLEMENT SCIENTIFIC KNOWLEDGE IN URBAN POLICYMAKING REGARDING SUSTAINABLE WATER MANAGEMENT



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REPORT

Knowledge Uptake from Lived Experience to Complement Scientific Knowledge in Urban Policymaking regarding Sustainable Water Management

Kennisopname van 'Lived Experience' als Aanvulling op Wetenschappelijke Kennis in Stedelijke Beleidsvorming voor Duurzaam Waterbeheer

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List of abbreviations

Abbreviation	
DI system	Drainage and infiltration system
ELT	Experiential Learning Theory
GGF project	Goedgefundeerd project (Well-founded project)
GOP project	GrondwaterOpPeil project (Groundwater at the right level project)
GRP	Gemeentelijk Rioleringsplan (Municipal Sewerage Plan)
HHSK	Hoogheemraadschap van Schieland en de Krimpenerwaard (Regional Water Authority Schieland and the Krimpenerwaard)
IWRM	Integrated Water Resources Management
LE	Lived Experience
LE_SWM	Lived Experience for Sustainable Water Management
MIRT	Meerjarenprogramma Infrastructuur, Ruimte en Transport (Multi-Year Programme for Infrastructure, Spatial Planning and Transport)
RWA	Regional Water Authority
SBH	Samenwerkende Bewonersgroepen Hillegersberg (Cooperating residents' groups Hillegersberg)

Preface

With one of my best friends, I was discussing what my next challenge might be. She knew my drive to work on impact regarding sustainability and my aspiration to leave a better world for the generations to come. ‘Start to study’, she just mumbled. And so, I did. My first intention was to gain more knowledge about climate change and the role of water through the pre-master Environmental Sciences. However, during this course, The Lived Experience of climate change holistic concept regarding water management caught my attention. As a result, I decided to follow the master course, because I was observing in practice that quite often scientists, civil engineers, and policymakers come up with sustainable solutions based on scientific knowledge in combination with the reasoning that they know the needs of citizens and their living environment. In my work abroad and the Netherlands, I noticed that sometimes this way of sustainable development is successful. However, sometimes it falls short. I became curious if and how local knowledge including Lived Experience and action learning could complement scientific knowledge in urban policymaking regarding sustainable water management. This question is relevant because of the mandatory citizen participation process in the Dutch Multi-Year Programme for Infrastructure, Spatial Planning and Transport, and the recently published AR6 IPCC report, which shows that we need to speed up sustainable development.

I would like to thank Jenny Fix, Ronald van Wingerden and Carola de Vree-van Wagtendonk of the Rotterdam municipality for enabling this assignment and providing access to the required content. In addition, I am grateful to all interviewees who took the time and effort to provide the data concerning this case study. The City Council and policymakers acknowledge that citizen participation could accelerate the sustainable development of Rotterdam. However, the level and the impact of how to participate leaves room for debate. This study could improve the insights into this discussion.

Furthermore, I would like to thank Paquita Perez. Your enthusiasm on this topic and your expertise inspired me to focus on the subject and to finish the report. As well as, I would like to thank Jean Hugé. You motivated me to improve the report, when I thought it was almost finished. In addition, I would also like to thank Ellen Tromp of Deltares. Your experience and input were a great help to this case study. Including the gentle comments, you made on the texts. Last, I would like to thank Audrey Hartman from Hartontwerp.nl for visualisation of the timeline and the cover of this report. Together we developed the infographic which shows in a blink the overview of the case study.

Finally, I express my thanks to my dear Leo, Jasper, and Lars. Whenever I said ‘I stop’ during this adventure, they confronted me with my pedagogical principle; finish what you start. Apparently, that also applied to me. Although I was working, studying, and mothering; stopping was no option. I am grateful that they were my faithful coaches during my journey. However, after 4 years I am looking forward to having free weekends together again!

Abstract

The world is changing rapidly; the population is growing, depleting the earth's natural resources. One of which is our water. Knowledge development for future-proof water management is therefore urgent and in this, involving local knowledge of the residents seems to become increasingly important. After all, every living environment has area-specific characteristics and, therefore, requires tailor-made knowledge development, whereby an intervention today will preferably lead to the same, or better, sustainable water management for generations to come.

Inviting citizens to this area-specific knowledge development and making use of local and lived experiences of the residents, is rather underexposed in the Global North. Central and local governments in, e.g., the Netherlands, are reminded by laws and regulations to involve residents and let them participate in environmental development processes. However, they are insufficiently aware of the possible contribution of lived experiences of residents and the joint action learning process to develop area-specific local knowledge that can contribute to local policymaking and possibly also to scientific knowledge development. Therefore, the following research question was defined: **How can knowledge uptake from Lived Experience complement scientific knowledge in urban policymaking regarding sustainable water management?**

To answer this question, we reviewed the literature for what is currently known about the concept of local knowledge for sustainable development and the Lived Experience of climate change holistic approach of Wilson et al. (2011). Recurring components in these 2 concepts were the meaning of learning, the elements of the communication process, and the trust and power components. Also, the approach of the Integrated Water Resources Management model was studied for the case study; the groundwater programme Rotterdam-Hillegersberg, in the Netherlands. We translated the results of the literature review into the theoretical concept and developed a corresponding analysis framework. Based on both, we accomplished the case study. First, we interviewed the 3 expert key persons. Subsequently, we performed the document study, and finally, we executed semi-structured in-depth interviews with 6 participants. We achieved the validation of the research via 2 triangulation steps. In addition, the expert key persons and the interviewees approved the reports, and part of our findings correspond to the independent Rotterdam Court of Audit report 2020 'Citizens at the Forefront'.

We conclude that in our case study, action learning took place and that local knowledge, enriched by Lived Experience, was developed. Here, we distinguished three types: i) the development of local knowledge through measurements by residents, ii) the development of local knowledge because the residents walk around frequently in their district and know the history of their neighbourhood; lived experiences and the 'eyes and ears in the field' for the civil servants, and iii) residents and civil servants cooperating to develop local knowledge by experimenting. Nevertheless, in this case, we learned that 5 aspects that influenced the collaborative action learning process for local knowledge development may be improved. First, an important element is to determine a clear and common starting point, including who facilitates the learning process and who records the progress. Second, to raise awareness to apply the Experiential Learning Theory of Kolb (1999, 2009) which is the basis of the applied theoretical concept. Third, the communication process can be improved by examining the transmission barriers regarding

language use and communication skills. In this case, the psychological barrier of cognitive dissonance concerning knowledge transfer also played a role. Fourth, the residents and the civil servants mistrusted each other regarding the sharing of the local knowledge originated through the Lived Experience. Finally, both parties accused each other of strategic power play regarding the uptake of local knowledge. In our case study, we unraveled that the civil servants seemed to act from the governmentality principle, according to Foucault (1980). After all, they have to take care of all the tasks and areas of the Rotterdam municipality and therefore act from the overarching needs and principles. However, the civil servants were unable to make this sufficiently clear to the residents. The barriers found, and the elements of trust and power, as defined by Tromp (2019) influenced the local knowledge transfer and uptake.

In our case, the cause of the calamity was a structurally low groundwater level in a residential area, causing houses may eventually collapse. We can conclude, using the studied theoretical concept and the analysis framework, that there was a joint action learning process for appropriate solutions partly originated through Lived Experience. This mutual learning process took place somewhat unaware. The Lived Experience appeared to be relevant for sustainable groundwater management in this residential area. Parts of the locally developed knowledge have been incorporated into the execution of the sewerage work. Furthermore, according to the civil servants, the developed local knowledge is mentioned as an alternative solution in the Municipal Sewerage Plan-5, next to the standard approach; groundwater management based on free decay. In addition, the residents and civil servant-experts performed a cooperative knowledge development step by validating the monitoring wells measurements of the residents and the Rotterdam municipality. However, within the delineation of this study, we cannot confirm to what extent this locally developed knowledge including the Lived Experience can also contribute to scientific knowledge development for sustainable water management. For that, more research is needed. In addition, more research is also required to detect possible other barriers and failure mechanisms for the transfer and uptake of local knowledge developed by Lived Experience.

Samenvatting

De wereld verandert in een rap tempo; de bevolking neemt toe waardoor de natuurlijke bronnen uitgeput raken. Eén daarvan is ons water. Het ontwikkelen van kennis voor toekomstbestendig watermanagement is urgent en de stem van de bewoners wordt daarin steeds belangrijker. Immers, elke leefomgeving kent gebiedspecifieke eigenschappen en heeft daarom kennisontwikkeling 'op maat' nodig; waarbij een ingreep op dit moment bij voorkeur leidt tot gelijkblijvend of beter duurzaam waterbeheer voor de generaties na ons.

Het betrekken van burgers bij deze lokale kennisontwikkeling, waarin ook gebruik wordt gemaakt van lokale en doorleefde ervaringen (Lived Experience) van de bewoners is in de westerse wereld tamelijk onderbelicht. Centrale en lokale overheden in bijvoorbeeld Nederland worden er bij wet wel op gewezen bewoners te betrekken en te laten participeren bij omgevingsontwikkelingsprocessen. Echter, op zoek gaan naar de lokale en doorleefde ervaring en samen, dus overheid en bewoners, actief leren ten behoeve van specifieke lokale kennis voor lokaal beleid en eventueel wetenschappelijke kennisontwikkeling is nog geen bewust standaard onderdeel van het participatieproces. Daarom is de volgende wetenschappelijke hoofdvraag tot stand gekomen voor dit onderzoek: **Hoe kan kennisopname uit 'Lived Experience' een aanvulling zijn op wetenschappelijke kennis in stedelijke beleidsvorming voor duurzaam waterbeheer?**

Om deze vraag te beantwoorden hebben we eerst in de literatuur gezocht naar wat er op dit moment bekend is over het concept lokale kennis voor duurzame ontwikkeling en de holistische benadering van de 'Lived Experience' van klimaatverandering van Wilson et al. (2011). Terugkerende onderdelen in deze 2 concepten waren de betekenis van leren, de communicatieproces elementen en de componenten vertrouwen en macht. Voor de casus, het grondwater programma Rotterdam in Nederland, is ook het geïntegreerd waterbeheer model (Integrated Water Resources Management, IWRM) bestudeerd. De uitkomsten van het literatuuronderzoek zijn vertaald naar het theoretisch concept en het bijbehorende analysekader. Gebaseerd op beide is de casus getoetst. Eerst door middel van gesprekken met de 3 sleutelfiguren, daarna de documentenstudie en vervolgens semigestructureerde gesprekken met 6 geïnterviewden. De validatie van het onderzoek vond plaats middels 2 triangulatiestappen. Tevens hebben de sleutelfiguren en de geïnterviewden de rapporten geaccordeerd en komt een deel van onze uitkomsten overeen met het onafhankelijke Rekenkamer Rotterdam rapport 2020 'Burgers op de Bres'.

Op basis van ons onderzoek kunnen we concluderen dat in de casus actief is geleerd en lokale kennis, verrijkt met doorleefde ervaringen, is ontwikkeld. We onderscheiden hierin 3 typen; i) het ontwikkelen van lokale kennis door metingen door bewoners, ii) het ontwikkelen van lokale kennis doordat de bewoners de historie van de wijk kennen en er dagelijks rondlopen; de doorleefde ervaringen en de 'ogen en oren in het veld' voor de ambtenaren, en iii) bewoners en ambtenaren die samen lokale kennis ontwikkelen door te experimenteren. Daarnaast heeft deze casus ons getoond dat een 5-tal aspecten kunnen worden aangepakt zodat het samen leren voor lokale kennisontwikkeling verbetert. Ten eerste; het is belangrijk een gezamenlijk en duidelijk vertrekpunt vast te stellen inclusief wie het leerproces faciliteert en de voortgang vastlegt. Ten tweede; het bewuster inzetten van de ervaringsgerichte leertheorie van Kolb (1999, 2009) die de basis vormt van het theoretisch concept.

Ten derde kan het communicatieproces worden verbeterd door de transmissie barrières wat betreft het taalgebruik en de communicatievaardigheden onder de loep te nemen. Ook speelde in deze casus de psychologische barrière voor de kennisoverdracht ook een rol, namelijk; de ontvanger begrijpt de kennis wel maar het past niet binnen zijn/haar waarden en normen. Dus, schuift het ter zijde. De vierde is dat de bewoners en ambtenaren elkaar over en weer niet vertrouwen in het delen van de lokale kennis die onder andere tot stand is gekomen door de doorleefde ervaringen. Als laatste bleek dat beide partijen elkaar betichtten van strategisch machtsmisbruik. In de casus leken de ambtenaren te handelen vanuit het gouvernementaliteit principe, gedefinieerd aldus Foucault (1980). Immers, de ambtenaren dienen zorg te dragen voor alle opgaven en gebieden in de stad en handelen hierdoor vanuit de overkoepelende behoeften en uitgangspunten. Echter, de ambtenaren konden dit onvoldoende duiden richting de bewoners. De gevonden barrières en de elementen van vertrouwen en macht, zoals gedefinieerd door Tromp (2019), hadden invloed op de lokale kennisoverdracht en de kennisopname.

In ons onderzoek was de oorzaak van de ontstane calamiteit een structureel te lage grondwaterstand in een woonwijk, waardoor op termijn de huizen kunnen instorten. We kunnen met behulp van het getoetste theoretisch concept en het analysekader concluderen dat er gezamenlijk is geleerd voor passende oplossingen, mede gebaseerd op doorleefde ervaringen. Dit gezamenlijk leertraject heeft zich deels onbewust voltrokken. De hierbij behorende doorleefde ervaringen lijken belangrijk te kunnen zijn voor een duurzamer karakter van de lokale oplossing(en) voor dit woongebied. Onderdelen van de lokaal ontwikkelde kennis zijn in ieder geval opgenomen in de uitvoer van de rioolwerkzaamheden. En, aldus de ambtenaren, sorteert de ontwikkelde lokale kennis ook alvast voor om naast de standaard aanpak, te weten grondwaterbeheer op basis van natuurlijke verval, in ieder geval genoemd te worden in het Gemeentelijk Rioleringsplan-5. Daarnaast is er een stap gemaakt in de kennisontwikkeling door het gezamenlijk valideren van de grondwaterpeilbuizen metingen van de gemeente Rotterdam en die van de bewoners. In hoeverre deze lokaal ontwikkelde kennis inclusief de doorleefde ervaringen ook kan bijdragen aan wetenschappelijke kennisontwikkeling voor duurzaam waterbeheer hebben we binnen de afbakening van dit onderzoek niet kunnen bevestigen. Daarvoor is meer onderzoek nodig. Evenals het detecteren en wegnemen van mogelijke andere barrières en faalmechanismen voor het delen en opnemen van lokale kennisontwikkeling, mede ontstaan door doorleefde ervaring.

Chapter 1 Introduction

1.1 Problem definition

The present global population is about 7.8 billion people. Despite the COVID-19 pandemic it is expected to increase to 10 billion inhabitants by 2050 (The World Bank, 2021a; The World Bank, 2021b). However, most of the global natural resources on earth are limited e.g., clean drinking water (Steffen, et al., 2015). Additionally, to these restricted natural resources, we are also facing global climate change. More extreme weather is posing risks to nature as well as in densely populated areas in the catchments. Unsustainable anthropogenic water management interventions can exacerbate pluvial flooding, devastating droughts, and deteriorating water quality in these river basins (United Nations, n.d.). Hence, many urban areas within river basins around the globe are at risk due to unsustainable water management. Especially in delta areas, this can result in an insecure living environment for the citizens (Adekola, 2018; De Graaf & van der Brugge, 2010; Hendriks, 2018).

Researchers and engineers are developing knowledge to design sustainable solutions to adapt to or mitigate these water risks of both shortage and flooding. The Netherlands, known for its engineering-driven water management is also facing these challenges (Ministry of Infrastructure and Water Management, 2020a). Consequently, the Dutch central government ordered the municipalities to conduct a climate stress test including water management assessment before the end of 2019 (National Climate Adaptation Strategy of the Netherlands, n.d.). Additionally, the Dutch central government is also facing the assignment of involving citizens in sustainable development (Ministry of the Interior and Kingdom Relations, n.d.; Rijksoverheid, n.d.). This participation process is also embedded in the Dutch Multi-Year Programme for Infrastructure, Spatial Planning and Transport (Ministry of Infrastructure and Water Management, n.d.).

The aim of this master thesis is to establish whether the local expertise, knowledge, and skills of the residents can positively contribute to solving the problem of water quality and water quantity in the city of Rotterdam, the Netherlands. We explore how to detect and uptake this resident-developed knowledge in local policymaking concerning sustainable water management in Rotterdam (De Graaf & van der Brugge, 2010; Frantzeskaki & Kabisch, 2016; Tromp, 2019). We will study the Bloemenbuurt, a neighbourhood in Rotterdam, and analyse if this case study can be a source of inspiration for other urban areas, in and outside the Netherlands.

Rotterdam is situated in the Meuse and Rhine catchment area of the Dutch delta (Rotterdam municipality, 2020a; Rotterdam municipality, 2021). Rotterdam is the second largest city of the Netherlands and resides about 645,000 inhabitants in 320,000 households (Statistics Netherlands, 2020a). The Rotterdam area, port of Rotterdam excluded, covers 325 km^2, whereof 218 km^2 land and 107 km^2 water (Statistics Netherlands, 2020b) (See Figure 1).

Figure 1. (a) Map of The Netherlands; Rotterdam is located in the red circle (b) the city of Rotterdam; the case study area is marked with a black dot (Google Maps, 2021)

Making use of the local expertise of residents in decision-making and science is not per se new. Among others, it was introduced by Wilson et al., in 2011 as the Lived Experience (LE) of climate change holistic approach. Abbott & Wilson (2015) explored via the LE holistic approach a wealth of narratives, local experiences, and local knowledge concerning the environment of communities. These local views and their diversity could be added to the existing knowledge of climate change and complement policymaking in an inclusive manner.

Abbott & Wilson (2015) considered the local knowledge and LE in developing countries and more specifically, in the rural areas. To reduce the vulnerability of those communities they developed participatory partnerships with the locals. Via social learning processes, Abbott & Wilson (2015) studied the locals, their relevant indigenous knowledge and the strategies how to cope with life-threatening situations in their habitat. Although the circumstances in the Global North are different from the mostly poor and vulnerable rural areas in the Global South, Wilson (2012) also explained the LE holistic approach via case studies in developed countries e.g., construction of a wind farm in the North of England and the Totnes Transition Town community in the South of England. Therefore, in our research, we will analyse the LE holistic approach adapted towards our case study in the city of Rotterdam, the Netherlands.

The heart of this approach is the experimental action learning cycle of Kolb, known as the Experiential Learning Theory (ELT) (Kolb, Boyatzis, & Mainemelis, 1999; Kolb & Kolb, 2009). ELT emphasizes the central role of experiences in the learning process. It clarifies that people learn by being actively involved through experimenting and reflecting on their experiences and developed knowledge. People have to be included in an activity to internalise the sustainable transformation. In response to proximate influences e.g., flooding, if the residents are invited, they can partake in the action learning process. Within their context, such as, cultural circumstances and personal histories, they can develop knowledge which could be valuable for science and for local policymaking (Abbott & Wilson, 2015b;

Adekola, 2018; Barth, Lang, Luthardt & Vilsmaier, 2017; Bryant & Thomson, 2020; Pérez Salgado, Wlison & van der Klink, 2014; Pérez Salgado, Abbott & Wilson, 2018; Wilson, et al., 2011).

The Lived Experience of climate change concept caught my attention during my working life. I observed several examples where scientists and policymakers came up with solutions based on the scientific knowledge that did not become fully embedded in the living environment of communities. Sometimes it failed because local knowledge was simply not included in the sustainable design. However, the Experiential Learning Theory of Kolb embedded in the Lived Experience of climate change concept is not just a participation trajectory. It's about seriously involving residents, allowing them to learn and to share the obtained information. Consciously as well as subconsciously dwellers can possess knowledge about their living environment that could enrich science and improve the quality of local policymaking for sustainable development (Clark, van Kerkhoff, Lebel, & Gallopin, 2016; Waas, Hugé, Verbruggen, & Wright, 2011). Therefore, the residents must be invited and given space to be able to learn. This way, they are in the position to contribute to sustainable solutions for their living environment, and possibly to knowledge development for sustainability.

1.2 Project target, research question and sub-questions

1.2.1 Project target

In this research, focussing on our case, we will explore if and how residents can construct knowledge regarding sustainable water management via collective action learning i.e., experiential learning. Furthermore, given this collective action learning process, we will investigate if and how civil servants can uptake this developed knowledge into the policymaking for the city of Rotterdam, the Netherlands.

In general, civil servants and regulators are facilitating the process of maintaining or improving the living environment in their city. They work in the triple helix with the industry (society), policymakers (politics), and science. Predominantly, they are involving residents by informing them. However, and specifically in our case study, the civil servants could improve sustainable development of the living environment by including these residents who are interested to partake in the action learning process. This way, the civil servants can trace if these residents possess Lived Experience (LE) knowledge and inspire these local communities to meaningful participation. This implies that ultimately the residents are invoked to be included in the local decision-making and policymaking for sustainability (Abbott & Wilson, 2015; Brundtland, 1987; Bryant & Thomson, 2020).

1.2.2 Aim of this study

The aim of this study encapsulates 3 perspectives; from the general -, the scientific - and the societal angle. The general relevance is in line with the overall purpose; we study the concept of Lived Experience knowledge development by residents for urban policymaking to accelerate sustainable water management (Bryant & Thomson, 2020; Pérez Salgado, et al., 2014; Wilson, et al., 2011; Wilson, 2012).

The scientific (theoretical) relevance is becoming more prominent since 1988, when the Intergovernmental Panel on Climate Change (IPCC) community was institutionalised. The IPCC is identifying the need of urgency and scale of climate change, involving scientists and practitioners from a wide range of scientific disciplines (The Intergovernmental Panel on Climate Change, n.d.). Hence, we emphasise the relevance of broadening the knowledge base of climate change because this phenomenon is a global multidisciplinary challenge. The effects of climate change are not linear. They transcend systems and borders and therefore require an integrated and inclusive approach. Throughout the years, the IPCC reports have become leading in the climate change discussion (The Intergovernmental Panel on Climate Change (IPCC), 2021).

Nevertheless, in our research we aim to detect how to construct new knowledge by bringing interdisciplinary scientists, practitioners, and residents together and introduce non-academic knowledge based on personal and collective life experiences (Wilson, et al., 2011, p. 5). To achieve this, all available knowledge must be collected within and across disciplines, sectors and target groups to find integrated solutions to mitigate the climate change effects (Abbott & Wilson, 2015; Clark, et al., 2016). In our case study, we zoom in on the process how to obtain and share the local knowledge developed concerning sustainable water management, bearing in mind the communication process and the elements of trust and power.

Concerning the societal relevance of this research, we would like to underpin the importance of actively involving local actors, being the residents, the ones who know their living environment. We underline the importance of creating a dialogue in which collective action learning is the standard. This, to develop inclusive and integrated solutions for sustainability (Abbott & Wilson, 2015; Ajzen, 1991; De Graaf & van der Brugge, 2010; Frantzeskaki & Kabisch, 2016; Tromp, 2019).

1.2.3 Research question and sub-questions

Following this line of argumentation, the following research question will be answered:

How can knowledge uptake from Lived Experience complement scientific knowledge in urban policymaking regarding sustainable water management?

To answer this research question, we will first study the existing literature to develop an understanding of the Lived Experience of climate change concept. Our study will focus on the learning- and communication process regarding sustainable water management in the Bloemenbuurt, a district in Rotterdam, the Netherlands.

Hence, the steering sub-questions are:

1. What is the definition of Lived Experience of citizens for sustainable water management measures in urban areas?
2. What communication process aspects can be identified for Lived Experience knowledge contributing to local knowledge development and what are the effects of trust and power in this communication process?
3. How can action learning of citizens be detected and contribute to local knowledge development for sustainable water management in urban areas?
4. What could be a procedure to facilitate the uptake of relevant Lived Experience knowledge into the urban policymaking process for sustainability?

1.3 Outline of the report

To answer the research questions, we will first outline the theoretical framework of the concept in chapter 2. We will elaborate on the accompanying communication process and the relevant influencing aspects of trust and power. We will also explain the criteria of sustainable water management referring to the case study. After the literature study, we will motivate our case study in chapter 3. In chapter 4, we will explain the research strategy and the methodological choices. Subsequently, we will analysis the data and report the results in chapter 5. Following, the conclusions are presented in chapter 6. We compare the findings to our consulted literature and reflect on the limitations of our study. Finally, in the last chapters, we discuss the findings and elucidate the recommendations of this research.

Chapter 2 Theoretical Framework of the Concept

2.1 Lived Experience of citizens for sustainable water management

2.1.1 Local knowledge and the Lived Experience holistic approach

The question arises what is currently known about local knowledge and Lived Experience. First, we will clarify the concept of local knowledge. Furthermore, we will illustrate the uptake of the local knowledge development with 3 lines of reasoning, confirmed by the literature. In addition, we will explain the Lived Experience concept as defined in the Lived Experience of climate change holistic approach. Finally, we explain how this approach is tailored toward sustainable water management.

Fischer (2000) argued in favour of the use of post positivistic[1] participatory research methods and methodological signals to facilitate more democratic environmental policymaking. He stated that more participatory forms of deliberation should be fostered. However, he acknowledged that citizen participation can be difficult and somewhat frustrating to implement in practice and definitely is not the sole solution towards inclusive decision-making for environmental challenges. Nevertheless, he reasoned citizens can be a link in identifying and maybe even solving environmental issues. Especially when these citizens possess local knowledge which can be used to enrich the research of experts. However, both have to pay attention that they talk a different language and view the same circumstance through another lens (Abbott & Wilson, 2015, p. 117). Fischer defines this local knowledge as knowledge 'pertaining to a local context or setting, including empirical knowledge of specific characteristics, circumstances, events, and relationships, as well as the normative understanding of their meaning' (Fischer, 2000, p. 194). Following this clarification of local knowledge, we would like to share 3 lessons learned from other case studies to comprehend the local knowledge development process.

First, we investigated the usefulness of local knowledge development and uptake for sustainable development. Clark et al. (2016) underlined that it is relevant to aggregate all usable knowledge of the specified environment for sustainable development. Several studies emphasise that an integrated and overarching knowledge collection is required to achieve an inclusive transition towards adaptation or mitigation strategies concerning climate change. Therefore, local actionable knowledge development can accelerate sustainability in urban areas because residents, living there for years, could possess Lived Experience of their living environment. They have knowledge that could enrich the sustainable development concerning their living environment (Bryant & Thomson, 2020; Clark et al., 2016; Frantzeskaki & Kabisch, 2016).

[1] A post positivistic research approach assumes that reality is subjective and socially constructed. The approach is based on the research question. Within the post positivistic approach, the correct scientific method does not exist. In most cases, a mix of scientific research instruments is applied. A positivist approach is a systematic, controlled, empirical and critical investigation of natural phenomena guided by theory and hypotheses about the presumed relations among the phenomena (Wildemuth, 1993).

Second, we considered the value of action learning in the living environment. Local knowledge can be observed from different perspectives. Frantzekaki & Kabisch (2016) as well as De Graaf & van der Brugge (2010) studied how local knowledge can be collected and used in local policymaking for sustainability in the city of Rotterdam, the Netherlands. Similar to Clark et al. (2016), they analysed all actors performing sustainable development by profession e.g., scientists, practitioners in water management and policymakers working in the sustainability programme of the city of Rotterdam. Therefore, a combined effort of different scientific disciplines and also an active dialogue between actors from policy and society is required. The intertwined connections between human and ecological systems are yearning to add insights to knowledge production.

Albeit, De Graaf & van der Brugge (2010) evaluated this process from the transition theory perspective, these studies emphasise that mutual learning is beneficial and can lead to useful and actionable knowledge which could be valuable for knowledge production. Concerning this type of mutual learning, scientists are out of their laboratories and in the position to connect knowledge to a local context and obtain more insights, as Clark et al. (2016) explained in their study. This can be appropriate for inclusive policymaking and sustainable development. As for all relevant professionals and most probably also other actors, they may learn to view the local circumstances through another lens which can be valuable for sustainable development according to Frantzeskaki & Kabisch (Clark et al., 2016; De Graaf & van der Brugge, 2010; Frantzeskaki & Kabisch, 2016).

Third, we addressed the sustainability learning process of practitioners as well as citizens. Leino & Deltomaa (2012) applied the 'situated knowledge' concept introduced by Haraway (1988), in a case study in Finland. The study object was the water quality of Lake Kirkkojärvi, in the South of Finland in between the urban areas of Helsinki and Turku. They underlined (as Haraway, who was inspired by Latour (1987)) that 'if knowledge is situational, it always carries the unique features of the practices that speaks up for local, specific, place-based knowledge that has its value on the particular situation at hand' (Leino & Peltomaa, 2012, p. 161). They concluded that there is a close interplay between knowing and doing concerning situated knowledge. Leino & Deltomaa (2012) analysed how local knowledge of citizens and legitimacy are developed and also shaped by one another when defined and applied by local professional actors. The involved citizens in this case study were mainly activist residents living around this lake. They were tired of waiting for an appropriate and widely supported solution to counter the smelly eutrophication of the lake. They wanted to improve the lake's water condition instantly. Hence, the residents took action by disseminating an effective micro-organism producing lactic acid, in the lake. The municipality administration fostered the creativity of these residents. However, the regional environmental authorities did not accept this experiment because of the lack of scientific evidence. Leino & Peltomaa (2012) analysed the residents' action and the effect of the media. However, in their scientific article, they did not explain how the situated knowledge was learned. Besides, they did not elaborate if the effective solution was included to develop new knowledge regarding combatting eutrophication of open water bodies.

The study of Barth et al. (2017) focused on social learning within local communities in the process towards a future-proof city of Lüneburg in Germany. They analysed a broad range of stakeholders who were participating in a well-structured community learning process for sustainable development. Social learning connects the learning of groups and between groups, to explore how to do things differently.

Dialogue and social negotiation are crucial in this learning process. Abbott & Wilson (2015) defined social learning as learning through interaction with others in a particular social context. However, little is known about how to initiate and support such forms of informal community learning in the context of sustainable development (Barth et al., 2017, p. 815).

Bryant & Thomson (2020) provided the evidence of the potential power of learning of municipality officials as a key leverage point for transformational sustainability change strengthened by an education and cultural change programme in the City of Canning, Western Australia. Wherein they substantiate that education is learning, not teaching. The study of Bryant & Thompson (2020) highlights 4 categories of results. i) The people; the human in the system with the shared purpose. They describe that the colleagues who started the journey received a budget of 4 hours a week to improve sustainability within their work and the team. Additionally, as in the study of De Graaf & van der Brugge (2010) there was a strong and dedicated managing director facilitating this participatory approach (Bryant & Thomson, 2020, p. 6). ii) The politics; implemented institutional instruments as an integrated approach to embed sustainability into the core council processes through a top-down Integrated Planning and Reporting Framework. Besides, the policy agreed on a positioning paper being the core message for the sustainability goals of the Council and its administration. iii) The education programme; underlined learning together as a key leverage point to develop mutual understanding i.e., language, trust and respect. iv) The actual sustainability initiatives as a result of the education, awareness raising and capacity building (Bryant & Thomson, 2020). They underline the relevance of learning together. However, they are not explicit about the result of the developed knowledge of learning together and if the outcome can be applied in scientific knowledge development for urban policymaking regarding sustainability.

Furthermore, the Brundtland report also being the basis of the positioning paper in the city of Canning, denoted that transformation requires embedding sustainability in education, overarching debates and public participation (Brundtland, 1987, p. 23). This report corroborates that citizens' participation can lead to local knowledge development for sustainability. They stated that the terms sustainability and sustainable development are interchangeable. As Waas et al. (2011), we use both as synonyms in our report.

Concluding, concerning local knowledge and social learning, we analysed the collective action learning and knowledge development in the Lived Experience holistic approach. In 2011, Wilson et al. introduced the Lived Experience holistic approach for climate change. They argued that the diversity of knowledge on climate change is connected to action-oriented and to social learning in groups. In their study, the variety of disciplinary, sectoral, and Lived Experiential knowledge, are all considered to be legitimate in the aim to construct new interdisciplinary and transboundary knowledge regarding climate change. From this angle, the Lived Experience holistic approach can be seen as one of the local knowledge development concepts, revealing how participants learn collaboratively to develop local knowledge and to take action to minimise the negative effects of climate change in their living environment.

Pérez Salgado et al. (2014, 2018) applied this Lived Experience concept in the Netherlands, Flanders and the United Kingdom. They connected abstract scientific knowledge concerning sustainability with the epistemological diversity of professionals. The interlacing of these elements was a source of action learning and holistic knowledge development. The concept identified the challenges of integrated

sustainable knowledge development. The practitioners got skilled by training the intervention competencies on how to evolve academic knowledge with the concept of Lived Experience.

Environmental researchers and also researchers in other scientific fields have referred to the Lived Experience holistic approach. As mentioned in paragraph 1.1, the learning process of this approach is the experimental action learning cycle of the American psychologist David Kolb. His Experiential Learning Theory (ELT) states that people require experimenting and experiencing to learn and to share knowledge. Besides, the German philosopher Jürgen Habermas argues that our capacity to reflect on what we do when engaging in action or with others because of our free will, is a way we learn and makes us human. Habermas studies our ability to interact and communicate with each other. Not just in the sense of conveying information, but to justify our reflections in the form of discussion, debate, and challenge (Wilson, 2012, pp. 20, 21; Habermas, 1984).

We aim to analyse that ELT is a distinctive element in constructing knowledge for sustainable development because it includes e.g., local experiences, non-documented historical facts, and storytelling, which has been searched for by experts as explained in the previously mentioned studies in several developed countries (Barth et al., 2017; Bryant & Thomson, 2020; Clark et al., 2016; De Graaf & van der Brugge, 2009; Frantzeskaki & Kabisch, 2016).

The ELT is based on two elements. First, to grasp the experience on the line of a concrete experience (sensing) and abstract conceptualization (analysing). Second, to process or transform the experience involving the active experimentations (do-ers) at one side and the reflective observations (watchers) at the other side of the scale. Furthermore, Kolb determined the 4 working styles being to diverge, to assimilate, to converge, and to accommodate, which should be applied during the experiential learning process. (Kolb, Boyatzis, & Mainemelis, 1999, pp. 4 - 6). However, in all situations count that in the space and time, the participants must feel the trust and psychological safety to take risks on the ‘team’ (Kolb & Kolb, 2009). Over time, the underlying ELT and the measuring instruments were tested and retested regarding reliability and validity in various disciplines. Therefore, it can be reasoned that the ELT is a useful framework for learning-centred innovations and even life-long learning (Kolb, Boyatzis, & Mainemelis, 1999, p. 22).

Wilson (2012) concluded that Experiential Learning Theory is the basic building block of the Lived Experience holistic approach, as shown at the bottom of Figure 2. The second building block is referring to proximate influences. In most cases, the participants are brought together caused by hazards or disasters. This can be direct natural disasters, e.g., hurricanes and floods. Or slowly developing hazards e.g., the effects of droughts, subsidence, and virus outbreaks. Cultural norms and values in a broader context are included at the third building block at the top of Figure 2. These socioeconomic and cultural circumstances are affecting the collective action learning process. Conflicting values can act as barriers (Abbott & Wilson, 2015b, p. 41, 117; Tromp, 2019). Other influences in the broad context are personal story-telling and dominant frames e.g., the human influences on climate change.

Furthermore, in the holistic approach, Wilson (2012) refers to the macro and micro-level of the internal relationships concerning trust and power. These philosophical concepts of trust and power of the internal relationships, thoroughly studied by Fischer (2000) concerning the local knowledge development, we will

examine in the communication process among participants and between the actor groups. Fischer (2000) and Wilson (2012) also explained that the relevant governmental entities have to apply the action learning outcome as these organisations know the needs and characteristics of the citizens. Both refer to the French philosopher Michel Foucault (1926 – 1984) citing the art of modern government through getting to know one's population (Foucault & Gordon, 1980, p. 124). This so-called governmentality is also reflected in our case study as the municipality of Rotterdam should be aware of what their residents need.

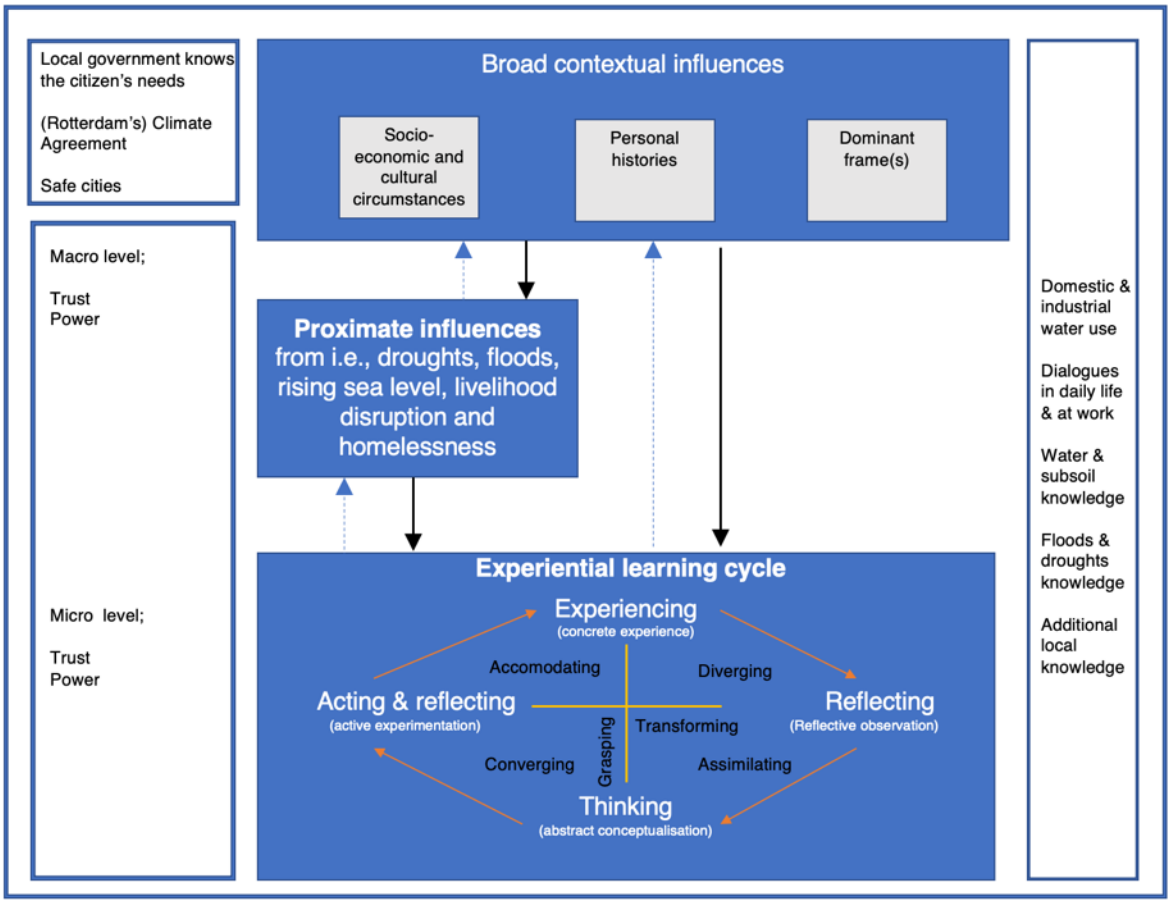

Figure 2. Concept of Lived Experience knowledge uptake to complement scientific knowledge in urban policymaking regarding sustainable water management, including action learning and the effects of trust, power and local knowledge development, adapted from Wilson et al. (Abbott & Wilson, 2015, p. 23; Pérez Salgado, Abbott & Wilson, 2018; Wilson, 2012).

In addition, the solid arrows in Figure 2 refer to the main direction of the influences. The dotted ones reflect the iterative processes. This explains why the experiential learning may affect the broader contextual influences and our capacities to handle the proximate influences (Abbott & Wilson, 2015, p. 23). In Figure 2 we customised and extended the Wilson's Lived Experience of climate change holistic approach concept to our research question; how to detect local experiences and the uptake in knowledge development in urban policymaking regarding sustainable water management in the city of Rotterdam, the Netherlands.

Regarding Kolb's Experiential Learning Theory, the experts and the learners with the relevant experience and the intrinsic motivation have to exchange thoughts somewhere, somehow. Together they re-think the circumstances at hand from the multifaceted system approach. The one who is in charge to take initiative

for these gatherings depends on the case and the place. As Tromp (2019) explains in the Gorinchem-Waardenburg situation in the Netherlands the residents need to be included because the implementing authorities have to deal with the assignment of involving citizens in sustainable development (Ministry of the Interior and Kingdom Relations, n.d.; Rijksoverheid, n.d.). This participation process is embedded in the Dutch Multi-Year Programme for Infrastructure, Spatial Planning and Transport, the so called MIRT (Meerjarenprogramma Infrastructuur, Ruimte en Transport) (Ministry of Infrastructure and Water Management, n.d.).

Since the implementation of the MIRT, this is generally applicable to all situations where Dutch governmental organisations wish to intervene in the spatial environment. Therefore, a clear communication procedure among the actors and a transparent process is required. Additionally, during the action learning process the participants need to develop the mutual understanding of words, concepts and their definitions. Several studies come to the conclusion that a transparent communication process and insights in the trust – and power in the perspective for collective action learning are key going forward to address social and economic benefits in an integrated sustainable way (Abbott & Wilson, 2015; Bryant & Thomson, 2020; De Graaf & van der Brugge, 2010; Foucault & Gordon, 1980; Frantzeskaki & Kabisch, 2016; Tromp, 2019).

Therefore, the determined problem statement can be defined in the following research question based on the studied literature: How can knowledge uptake from Lived Experience complement scientific knowledge in urban policymaking regarding sustainable water management?

2.1.2 Contribution of citizens to knowledge development

The question we would like to address is whether local knowledge development can be acknowledged as a contribution to academic knowledge? Abbott & Wilson cited the study of Carrapatoso & Kürzinger (2014) questioning to what extent there is a level of carefully controlled experiment in local knowledge development (Abbott & Wilson, 2015, p. 117). Furthermore, they clarify that local knowledge is not a synonym for Lived Experience. However, both i) demonstrate that people are not passive in the face of their living environment and climate change, ii) show what works on the ground in the field, iii) is knowledge required by practitioners, and iv) a more democratic way of decision making through a participatory process. They characterized 3 main challenges. First, the acceptance of this knowledge by professionals and decision-makers as a valid form of knowledge and the power relations between different forms. Second, the possible exploitation when extracted knowledge is not mutually shared. And third, the power relations between experts and locals in collective experiential learning processes that are intended to engender space for sharing knowledge (Abbott & Wilson, 2015, p. 124). However, since in most case studies the experiment is not scrutinized, it is difficult to determine what the contribution to knowledge development is and it should be studied case by case (Clark et al., 2016).

2.1.3 Sustainable water management in the city of Rotterdam, the Netherlands

Sustainable water management in urban areas situated in a river catchment will be clarified from an Integrated Water Resources Management (IWRM) approach, embedded in the Dutch Water Directive Framework 2020 – 2027 (Rijkswaterstaat WVL (Water, Verkeer en Leefomgeving), n.d.). The main water challenges within these models are floods, droughts, and water quality. These water-related hazards are having a strong connection with the environment-specific subsurface conditions and climatological circumstances. These characteristics are also applicable for Rotterdam, located in the Dutch Rhine – Meuse watershed (De Graaf & van der Brugge, 2010; Dunn, Brown, Bos, & Bakker, 2017; Gleick, 2018; National Climate Adaptation Strategy of the Netherlands, n.d.).

The study of De Graaf & van der Brugge showed that the fragmentation of water management responsibilities between the Regional Water Authority Schieland and the Krimpenerwaard (Hoogheemraadschap Schieland en de Krimpenerwaard, HHSK) and the municipality of Rotterdam did not encourage the end-to-end sustainable development of the overall water system in and around the urban area. Instead, they had to develop technical solutions in, and with the existing urban environment. Since the start of this Millennium, it has been acknowledged that the quality of the several living environments could be restored and even improved through new water retention infrastructure. However, all relevant stakeholders must partake in the design process whereby the water -, and the other urban development challenges have to be combined.

Today, as in the study of De Graaf & van der Brugge (2010), the water challenge is defined as creating sufficient peak retention capacity, increase seasonal water storage, and optimise a denser network of water ways to control groundwater (Rotterdam municipality Urban Management Department, 2020). The latter is important for our case study and will be analysed in detail in the groundwater programme Rotterdam-Hillegersberg documents. In this neighbourhood, the residents are concerned because of i.e., the cracked walls in their houses due to lowering groundwater level and subsidence.

2.2 The communication process and the LE holistic approach concerning sustainable water management

2.2.1 The communication process

Frantzeskaki & Kabisch (2016) explained the importance of building dialogue amongst actors to connect scientific knowledge to the local context. They even refer to the lack of communication between civil servants in different city departments of the Rotterdam municipality, which could be an extra obstacle. They conclude that it is the responsibility of the organisers of the knowledge co-production processes during the preparation phase to carefully select which actors will participate to minimise the communication barriers. Tromp (2019) identified these barriers and failure mechanisms in the communicative interaction between individuals. For this purpose, she analysed multiple processes of knowledge transfer ex-post and during flood defences design. She studied these communication processes among professionals and between professionals and citizens. Upon these outcomes and regarding the ex-post case of our study, we adjusted the sender-receiver framework for knowledge transfer and uptake, as shown in Figure 3.

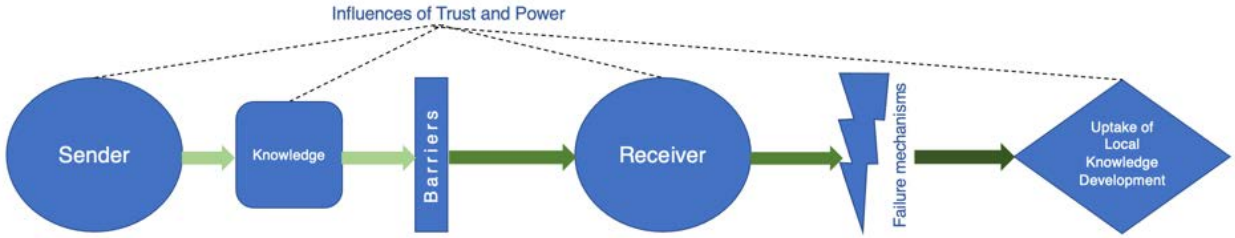

Figure 3. The one-dimensional sender-receiver process for knowledge transfer and uptake concerning the ex-post case study (Tromp, 2019, p. 18).

The Sender of the Knowledge aims to share the prerequisite knowledge. Tromp (2019) analysed 3 kinds of barriers; transmission -, cognitive – and, psychological barriers. The transmission barriers affect the flow of information between Sender and Receiver. This includes the barriers stagnating the communications e.g., time, place, noise nuisance, language use and poor audio-visual equipment. And in some cases, also insufficient communication skills of Sender and/or Receiver. The cognitive barriers occur when the Receiver does not master the relevant prerequisite knowledge. And, the psychological barriers arise when Receiver understand the knowledge, however it is not consistent with the beliefs of Receiver, known as cognitive dissonance. Therefore, Receiver cannot act upon Knowledge because it is conflicting with the core values of Receiver and/or relevant actors in Receiver's surrounding.

The Uptake of Local Knowledge Development is the result of the collective action learning process which can be hampered by 7 failure mechanisms. The first 4 according to Tromp (2019) are; the incorrect use of the knowledge, the institutional restrictions corresponding with the core values and norms, resource restrictions and dissipation. Furthermore, she detected disqualifying knowledge, no receipt of the knowledge transfer and strategic power play within the collective action learning process (Tromp, 2019, pp. 25, 26). The latter will be further explained in paragraph 2.2.3. We apply the one-dimensional sender-receiver process in our ex-post case study because the communication processes including trust and power play a role regarding the knowledge sharing and transfer in the collective action learning process within the Lived Experience holistic approach for sustainable water management, as shown in Figure 2.

2.2.2 Trust

Amongst others, Bryant & Thomson analysed by developing the education programme that the underlining learning was to create mutual understanding (language), trust and respect (Bryant & Thomson, 2020, p. 7). To bear in mind that Kolb (1999) mentioned that trust is a precondition for social learning, Tromp (2019) states that knowledge transfer is more effective when the receiver views the sender and its shared knowledge as benevolent and competent. Therefore, 2 types of trust are distinguished for the receiver. First, is the benevolent-based trust explaining the belief that the sender intrinsically sincere is interested in the collective action learning process and to share knowledge. Second, is the competence-based trust referring to the belief that the sender is knowledgeable i.e., an expert concerning the subject. Following Tromp and Foucault there is a third element; the interpersonal trust (Foucault & Gordon, 1980; Kolb & Kolb, 2009; Tromp, 2019). In our case study, we aim to detect these 3 elements of trust.

2.2.3 Power

Practically nothing is as confusing as power. Notwithstanding, we strive to detect the power components in our research. We demarcate the definition of power within the Lived Experience holistic approach to developing local knowledge and the power in the communication process in the sender-receiver approach concerning knowledge sharing, transfer and uptake (Tromp, 2019; Wilson, 2012). We observe 3 manifestations of power, regarding our case study.

First, Foucault reasoned that power is accepted because it does not only put pressure on us as a force that says no, however, it also produces positive matters. Herewith, he refers to the modes of exercising power. In contradiction to the negative connotation of the word power, Foucault discoursed that power induces pleasure, constructs knowledge, and enforces discussion. In addition, Foucault elucidated that the State consists in the codification of a whole number of power relations that renders its functioning possible. He underpinned that today it is impossible to govern a State and its organisations without knowing its population; their needs, their worries, and their characteristic. He called this governmentality. It indicates the technologies and self-consciousness, with which a governmental organisation governs and with which rationality it legitimises itself. It thus concerns both the exercise and the reflection of political power. (Foucault & Gordon, 1980, p. 124; Morrison, et al., 2019, p. 3; Wilson, 2012, pp 38, 51).

Second, Foucault cited by Wilson (2011), questioning whose knowledge counts concerning power. In addition, Wilson & Abbott (2015) argue that if more knowledge is more power, less knowledge could result in less power. Fischer (2000) evaluated the issue of the relation of knowledge to power and learned that much of the studies have been purely theoretical. The practical question of the relation of the citizen to the expert including the knowledge of the power relation remains vague and inadequate, according to him. However, the study of Tromp (2019) is referring to one of the 7 failure mechanisms, the strategic power play, to uptake knowledge. Herewith she corroborates that there could be practical evidence that the transmission of knowledge can be obstructed by a power component.

And third, power counts in all types of governmental organisations. Morrison et al. (2019) explain in their study the polycentric system[2] and revealed the power gap in polycentric governance focusing on power as the uneven capacity to influence the goals and processes. They define the outcomes of polycentric governance via (i) power by design, (ii) pragmatic power and (iii) framing power. Power by design is written, legislated, and visible within the deliberate design of governance. It is based on the legitimate authority of states and other powerful actors to independently legislate, create formal rules, tax, distribute resources, and design policy and markets. The pragmatic power is exerted through the day-to-day practice and implementation of formal and informal rules and norms. And framing power is a competence of e.g., lobbyists, non-profits, and the media. These actors are bargaining for influence through rational and manipulative persuasion, inducement, sanction, and coercion. These polycentric power typologies, which also apply for the Rotterdam municipality according to Hendriks (2016), can

[2] A polycentric system represents multiple governing authorities at different scales and different levels. These scales and levels do not have mutual hierarchical relationship but are engaged in self-organisation and common adjustment. In contrast with conventional monocentric governance in which an ideal monocentric system is controlled by a central predominant authority. Polycentric governance is understood to provide more opportunities for representation of different social actors than monocentric governance (Morrison, et al., 2019).

accelerate the understanding of polycentric governance by encouraging analysts to shift focus to examining the power-laden conditions that enable different types of actors, with different types of power, to achieve their preferred outcomes (Hendriks F., 2006; Morrison, et al., 2019).

Following the line of reasoning of the theoretical concept of the Lived Experience holistic approach, we aim to detect Foucault's governmentality power definition in our case study. Herewith we take into consideration the polycentric power typologies; power by design and pragmatic power. Furthermore, and if applicable, we study the strategical power play elements of Tromp (2019) and the possible relation with the framing power in the communication process.

Chapter 3 Case Study

In this chapter, we will outline the case study. We will elucidate on sustainable groundwater management in a district in the Rotterdam municipality, the applicable law, and legislation of this natural resource in general, and the involved departments of the city of Rotterdam. Furthermore, we will explain the chosen location and the selected time scale of our research.

3.1 Subjects of the case study

We zoom in on the sustainable groundwater management in the city of Rotterdam, as explained in paragraph 2.1.3, and analyse if knowledge uptake from Lived Experience of residents can complement scientific knowledge in urban policymaking regarding this natural resource. Since the introduction of the Water Act in 2008, the city of Rotterdam, like every municipality in the Netherlands, has a responsibility to safeguard the groundwater level within its municipality boundaries (Ministry of Infrastructure and Water Management, n.d.; Rotterdam municipality, 2020b). This task is managed within the water department of the Rotterdam municipality, part of the Urban Management cluster. In addition, house owners are liable for the groundwater level and the rainwater discharge of their lot. Furthermore, they are also responsible for a solid foundation of their house and outside the case study but relevant to mention, a waterproof roof construction.

The foundation department of the Rotterdam municipality, organised within the Urban Development cluster, realises that the foundation of houses are human-made elements and integrated into the natural water- and soil system of the environment. A foundation (partly) made of wood must remain immersed in the water to retain its strength. Therefore, if the groundwater level in the subsurface is not sufficiently high due to droughts and/or subsidence, the foundation poles dry out and will be affected by fungi and bacteria. In case the groundwater level cannot be replenished these wooden foundation poles rot away over time. Therefore, to safe keep these houses, phreatic groundwater and the accompanying groundwater table are essential (Rotterdam municipality, 2020c).

In line with the compulsory climate stress test by the Dutch government and the ‘Notitie Reikwijdte en Detailniveau’ concerning the environmental vision of Rotterdam, the Rotterdam City Council is dedicated to let its citizens participate in policymaking for urban development and - management to achieve a climate-neutral and future-proof city by 2050 (Rotterdam municipality, 2020d; Rotterdam municipality, 2020e). From this perspective sustainable groundwater management is also a component of this target and the responsibility of the Services cluster, the third cluster within the Rotterdam municipality involved in our case study.

Notwithstanding, the dedicated civil servants of these 3 different clusters are joining hands to collect ideas, opinions, and local experiences of citizens regarding (sustainable) water management (Rotterdam municipality Urban Management Department, 2020). However, each cluster has its own board of directors. And all clusters have to deal with a new Board of Aldermen and City Council every 4 years. Therefore, it is challenging to act as one municipality towards the residents.

3.2 Location of the case study; the Bloemenbuurt

We selected the residential area Bloemenbuurt in the district Hillegersberg-Schiebroek, situated in Rotterdam-North, see Figure 1 and 4. The Hillegersberg-Schiebroek district covers 6.26 km^2 and houses about 44,500 citizens (Rotterdam municipality, 2020f). The Bloemenbuurt area accommodates approximately 2,450 residents sharing about 1,146 households across 506 properties.

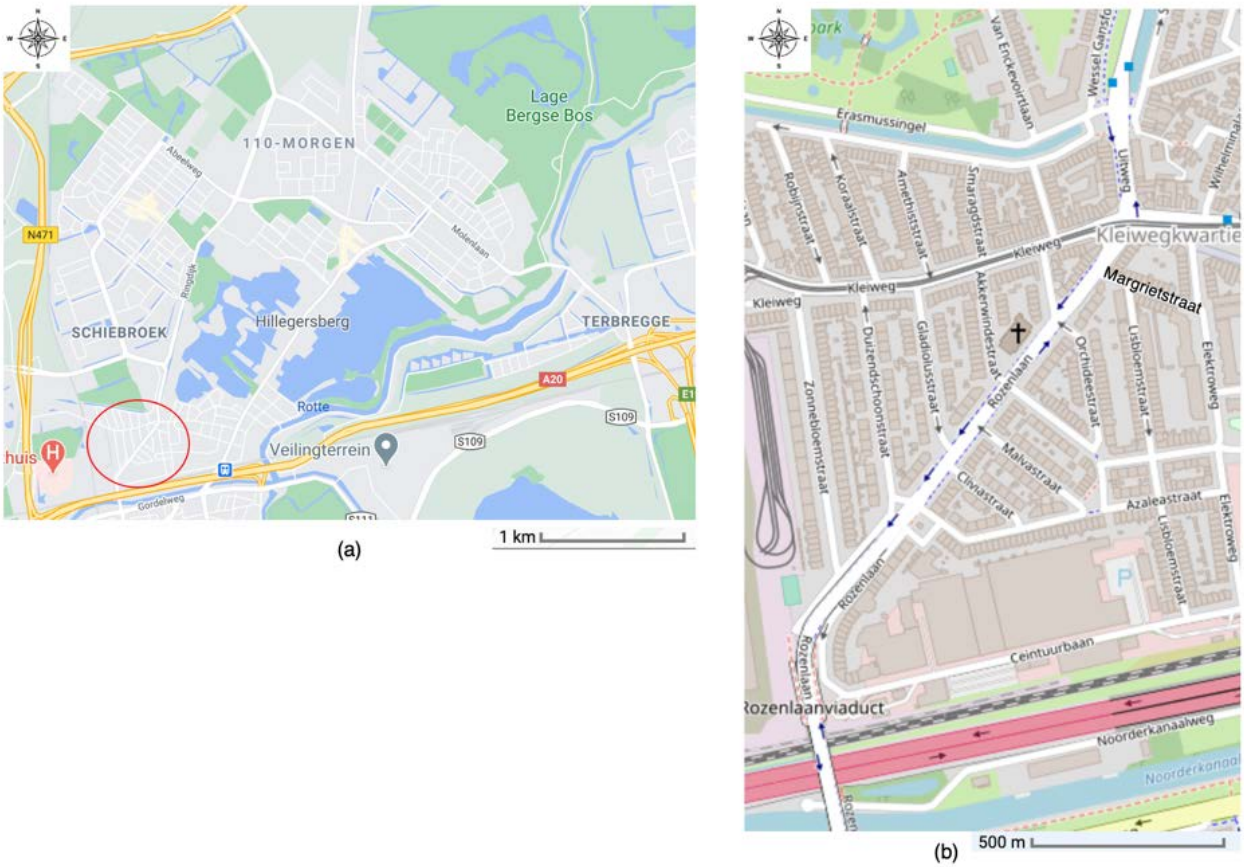

Figure 4. (a) Map of Rotterdam, district Hillegersberg-Schiebroek; the case study area is marked in the red circle (Google Maps, 2021) (b) the Bloemenbuurt; detailed map of the case study area at street level (https://www.openstreetmap.nl/, 2021).

The Bloemenbuurt is one of the areas in Rotterdam where the foundation of many houses is suffering from pole rot due to lowering groundwater tables since 1950, in combination with natural subsidence of the subsurface. Hence, the groundwater level in this area has been structurally low compared to the ground level since 2005. That the situation was urgent became evident, mid-2014, when several houses in the Margrietstraat, were evacuated due to collapse-risk caused by pole rot in the foundation of the houses, see Figure 5a. In 2015, the residents of the Bloemenbuurt asked for assistance from the Rotterdam municipality as cracks occurred in the walls and the unknown state of their houses' foundations. The forward-sloping facades and the cracks in the exterior walls are still present while we conduct our research, see Figure 5b (2021).

Figure 5a. One of the properties on the Margrietstraat was threatened with collapse risk caused by pole rot in the foundation (Rijnmond, 2016)

The affected residents[3] have been and are still proactive and organised in the 'GrondwaterOpPeil' project and collaborate with the 'InHillegersberg' residents' group (Grondwateroppeil, 2020; InHillegersberg, 2020). This location choice is justified because of the urgency of the situation in combination with the fact that there has been an intervention in this area, explained below, that may lead to the new additional knowledge in relation to our research question.

Figure 5b. Properties on the Elektroweg with forward-sloping facades and the cracks in the exterior walls (left) and a crack in the exterior walls of the not rebuild properties on the Margrietstraat (right) (2021).

[3] The case study does not clarify which circumstances in combination with climate change affected the houses of these residents.

3.3 Time scale of the case study; 2016 - 2020

During 2016 – 2017, the sewers and the drainage and infiltration (DI) system in the Bloemenbuurt area were replaced. In the preceding meetings, the involved parties (workers of the water department and the residents) acknowledged that this DI system could help to control the groundwater level in and around the public area of this zone. However, to connect the DI system and allow the surface water of the Erasmussingel to infiltrate to increase the groundwater level and the other way around was a subject of discussion. Various consultations took place. For our case study, we analyse the intervention moments from 2016, up to and till 2020, when the Rotterdam Court of Audit– 'Citizens at the Forefront' ('Burgers op de Bres') report was published (Bosch, van der Greft, & de Vries, 2020).

Throughout this timeframe, the civil servants of the Service -, Urban Development - and the Urban Management cluster applied the participation process protocol. The civil servants and residents developed a tailor-made technical solution together, being active groundwater management with pump and pressure pipeline, see Figure 5c (2021). Nonetheless, during this process, they were unaware of the action learning activities or who contributed what kind of knowledge. They hardly recognised the effect of the possible uptake of local knowledge including Lived Experience during the implementation of the work nor embedding this kind of local knowledge in the urban policymaking for sustainable (ground)water management (Bosch, van der Greft, & de Vries, 2020). The client's rationale for the main research question was how to organise this process more smoothly to develop and apply local knowledge arising from Lived Experience.

Figure 5c. The pump at the Erasmussingel (left) for active groundwater management in the Bloemenbuurt and the overflow pit including an automated logger on the Akkerwindestraat (right) connected to the pressure pipeline (2021).

Chapter 4 Research Strategy and Methodology

In this chapter, we outline the research strategy and explain the methodological choices regarding our case study. First, we discuss the way the research is designed. Subsequently, we clarify how we selected and collected the data regarding our case study. Furthermore, we will elucidate on how we prepare and analyse this data. Then we underpin the validity and reliability of the results regarding the case study and elaborate on the ethical considerations concerning the research.

4.1 Research Strategy

4.1.1 Research purpose

We aim to identify the conditions that facilitate the action learning process with residents regarding sustainable groundwater management in their living environment. We search for the local knowledge elements or types, being the Lived Experience (LE) of the residents in this process. We aspire to trace how this local knowledge development including LE can complement scientific knowledge in urban policymaking regarding sustainable water management. In our case study, we examine this process regarding the groundwater programme Rotterdam-Hillegersberg focused on the Bloemenbuurt district in Rotterdam, the Netherlands. We found it striking that the programme had no official working name within the municipality of Rotterdam until this research started, while the residents had been working on what they call the 'GrondwaterOpPeil' project since 2017.

In our approach, we study the Lived Experience (LE), the Experiential Learning Theory (ELT) and the communication process; including the components of trust and power. These mediating components modify the learning process and clarify the theoretical concept of the Lived Experience holistic concept for sustainable water management (LE_SWM). We will analyse these components concerning 3 actor groups, being the residents and 2 kinds of civil servants. One is the engineers, the experts concerning the water - and soil system. The other is the process facilitators, the professional organizers of the consultation structures and meetings.

Subsequently, we will detect the action learning processes of the LE_SWM concept whereby we will focus on how the LE and/or knowledge elements of the residents is retrieved and applied in this phase of the groundwater programme Rotterdam-Hillegersberg, in the Netherlands. We will investigate whether the developed local knowledge originated through Lived Experience of the residents is embedded to complement scientific knowledge in urban policymaking regarding sustainable water management.

Based on the outcome, we intend to propose evidence-based interventions and further research how to involve residents to participate in action learning including their Lived Experience for sustainable water management in their neighbourhood concerning the next phases of the groundwater programme Rotterdam-Hillegersberg.

4.1.2 Research design

We underline that an inductive line of reasoning is applied for our research. Our case study is explorative in nature and might lead to new additional elements of local knowledge development to the Lived Experience holistic approach concept applied to sustainable water management (Robson, 2002, pp. 473 - 475). The holistic single case study of the groundwater programme Rotterdam-Hillegersberg, will be performed as an empirical inquiry and we will analyse a particular phenomenon, being the Lived Experience (LE) knowledge elements developed in a real-life context. An ex-post case study is a method of testing a complex phenomenon, according to Robson (2002) and Baxter & Jack (2008). They see a case study as a method to understand how the involved participants in a certain project, view the subject and try to influence each other. The Lived Experience, local knowledge and sustainable water management are complex phenomena in which human action and interaction form the basis. The (direct) causal relation between the LE knowledge elements development and the context is not evident and will be investigated via our research strategy by using multiple sources of evidence. We realise that with the suggested mixed methods, it is challenging to assess causal relationships (Robson, 2002, pp. 163 - 200, 358).

Furthermore, a holistic case study is appropriate regarding our research because of the underexposed question of how to involve the residents regarding sustainable development. The theoretical understanding explained in the LE_SWM is clear and unambiguous. The groundwater programme Rotterdam-Hillegersberg case study offers a set of circumstances where the predicted outcomes could be found. This case study can detect the line of reasoning which can create understanding and maybe lead to new knowledge on how to collect Lived Experience for local knowledge development obtained via action learning with residents to improve sustainable water management (Robson, 2002, p. 182). Figure 6 shows the research design which we will clarify below.

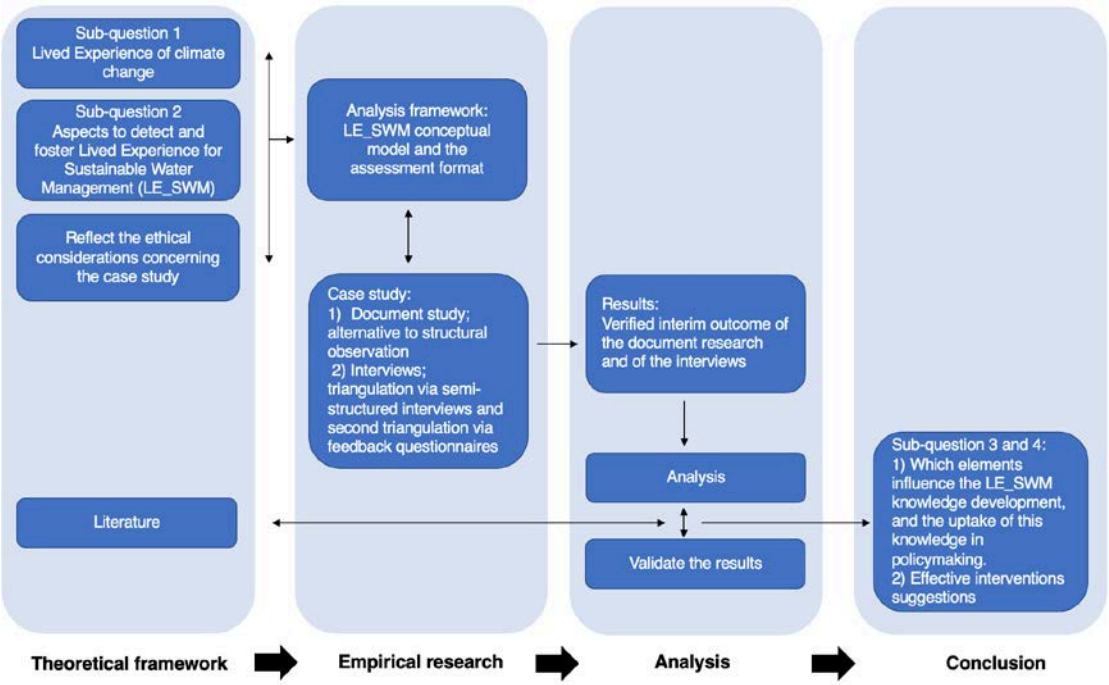

Figure 6. Research design of The Relevance of Knowledge Uptake from Lived Experience to Complement Scientific Knowledge in Policymaking Regarding Sustainable Water Management.

During the theoretical framework phase, we study relevant literature to substantiate whether and how to apply Lived Experience of climate change regarding sustainable water management, being the conceptual

model. Based on this conceptual model and through an iterative literature review, we detect the variables for Lived Experience for Sustainable Water Management explained in Figure 7 (Baarda, 2014). First, the independent variable is the Lived Experience and connected action learning with residents directing to the dependent variable, the local knowledge development. Second, the mediating variables which are the communication process, the level of trust and the power elements. Third, the moderating variables, in our case the 2 different kinds of civil servants.

The results of the literature review are input for the theoretical concept and the analysis framework of the case study. To refine the results of the literature review and the structure of the analysis framework, 3 in-depth interviews are held with expert key persons in the field of Lived Experience and/or local knowledge uptake and involving residents regarding sustainable water management. Upon these variables and the reflection, we compile the assessment format and define 7 inquiry categories accompanied by the issues and components we found in the studied scientific literature.

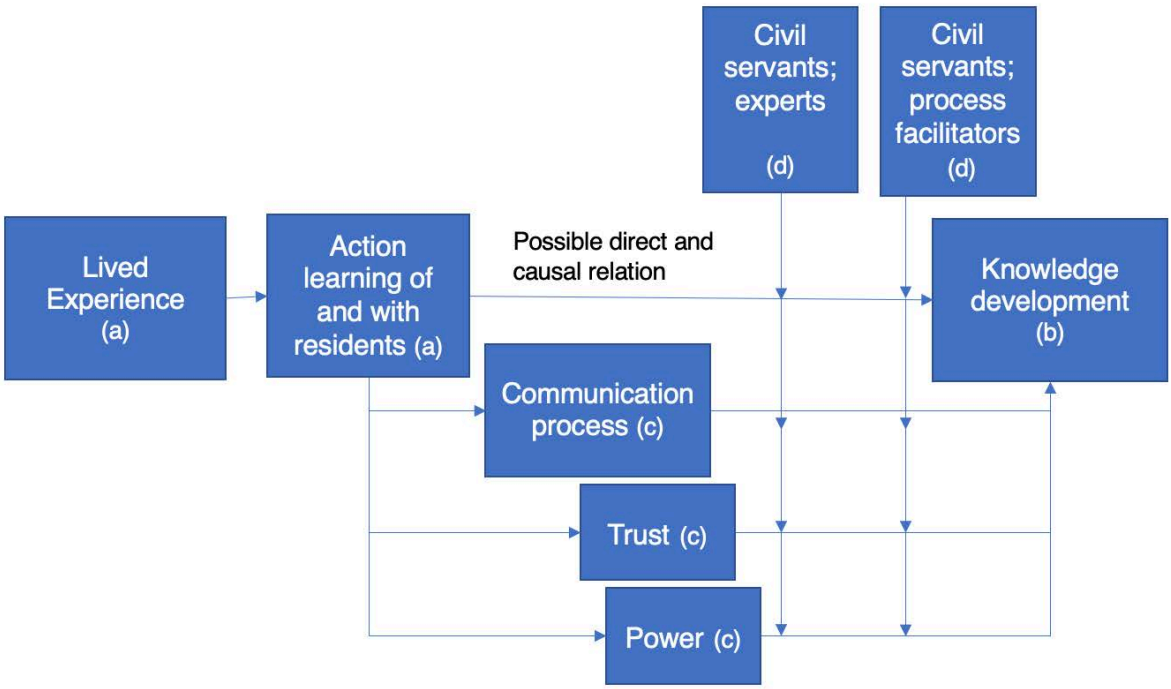

Figure 7. Lived Experience knowledge uptake to complement scientific knowledge in urban policymaking regarding sustainable water management with the independent variables a) action learning of and with the residents and dependent variable b) knowledge development. Additionally, the mediating variables c); the communication process, trust, power and the moderating variables d) being the two different groups of civil servants (Baarda, 2014).

In the second phase, we apply a mixed method approach to generate the datasets. This way, we aim to reduce inappropriate certainty and employ triangulation (Robson, 2002, pp. 459, 473 - 486). We investigate in practice by means of a desk research and interviews in the field. The obtained insights will be compared with the assessment format of the literature study. Hence, we categorize our study as a qualitative case study (Robson, 2002, p. 458).

In the analysis phase, we will reflect on the results of the ex-post holistic single case study providing insights into how and to what extent Lived Experience has or has not supported the component

of local knowledge development for sustainable water management. The findings from practice are linked to the theoretical concept. We will then link these generalisations to a formalized body of knowledge in the form of a construct or a theory and validate the results (Robson, 2002, p. 459).

In last phase, we will draw our conclusions concerning the LE_SWM and which elements influence the local knowledge development, including the uptake of this knowledge in urban policymaking. Based on these scientifically sound conclusions, we will propose our recommendations.

4.2 Methodology

4.2.1 Data gathering, selection and analyses of the documents

We will apply a document study to acquire an overall view of the local knowledge production process in practice. Via this unobtrusive observation manner, we aim to detect the timeline of the groundwater programme Rotterdam-Hillegersberg including whether and how local knowledge is developed (Robson, 2002, pp. 348 - 351).

However, we have to bear in mind that the available groundwater programme Rotterdam-Hillegersberg documents were not produced for this research. Robson (2002) argues that using documents to collect data can be considered as a scientific-based method. Nevertheless, he emphasizes that validity and reliability are central concerns in the content and context analysis of this approach. Therefore, which documents will be examined must be clarified. In addition, the reading process must be explained and also verified (Robson, 2002, pp. 185, 350).

We obtain all available documentation via the client concerning the groundwater programme Rotterdam-Hillegersberg regarding the Bloemenbuurt, between 2016 - 2020. In the first selection, we scan the entire document collection and marked the selected documents following two features. First, is the document shared with the residents or are the residents mentioned in the document? Second, can we trace Lived Experience, action learning or local knowledge development words in the document? Furthermore, we select additional documents following the same process via the up-to-date websites of the ‘GrondwaterOpPeil’ project group and the residents’ groups ‘In-Hillegersberg’. We noticed that some documents appeared in both datasets. The selected document dataset comprehends 40 documents (Word and PFD's), concerning 691 pages, 7 PowerPoint presentations containing 247 slides, 2 Excel files and, 3 news articles.

Subsequently, we ordered the selected documents, numbered them, and listed the source. We studied these selected documents in depth and identified the (collocations of) word(s) mentioned regarding the determined interdependent and dependent variables and the mediating variables. In addition, we mark the positive or negative connotations e.g., angry, defensive, agree, and happy articulations (Robson, 2002, pp. 353 - 357). We register these findings per document in the compiled assessment format. During this process, we also construct the timeline of the meetings and relevant occasions e.g., observations in the field, Lived Experience, local knowledge development, execution work in the Bloemenbuurt area, weather conditions and media exposure.

On the basis of the filled-in assessment format and the timeline, we determine the interim outcome of the document study (Robson, 2002, pp. 473 - 486), see Annex I, the Interim Report of the

Document Study. To validate this interim outcome, we reflect with our supervisor, external co-assessor and the 3 expert key persons. After their feedback and approval, we use this dataset as the first step of the mixed-method approach of our case study (Robson, 2002, p. 352).

Next, we analyse the gathered and grouped document dataset by iterative comparison per inquiry category. In the comparative aim, we ask ourselves to reason what we found with what has been previously observed, interpreted, or studied by others. In our case study, we use secondary empirical comparison. The issues and components found in the scientific articles of our literature study are compared to descriptions in our document study (Verschuren & Doorewaard, 2016). We described the outcome and the accompanying analysis of the document study in respectively paragraph 5.2 and 5.3.

4.2.2 Data gathering, selection and analyses of the interviews

In the second step, to reduce inappropriate certainty and to employ triangulation, we accomplish our qualitative research by interviewing the selected respondents. The reasoning for purposive sampling regarding the selection of the respondents is discussed with the supervisor and the external co-assessor (Robson, 2002, pp. 264, 265). We informed our client concerning the selection results. We decided to interview 3 residents living in Hillegersberg and are involved in the 'GrondwaterOpPeil' project. One of the interviewed residents is living Oud-Hillegersberg, another neighbourhood in the foundation-risk area of our case study. The other 2 are Bloemenbuurt residents. Furthermore, we selected 3 civil servants. One working at the Services cluster, one expert working at the water department of the Urban Management cluster, and one expert working as a hydrologist at the engineering office of the cluster Urban Development.

The procedure to invite the interviewees, performing the interview and the communication to cross check the interview report will be identical as much as possible for all interviewees. Besides, we aim to keep the external factors that can influence the interview, as equal as possible. However, due to the COVID-19 pandemic situation in the Netherlands, it is unavoidable that some interviews will be online via MS Teams, and some offline, bearing in mind the compulsory measures (Robson, 2002, pp. 270 - 290).

Subsequently, we accomplish the interviews one-to-one and one-by-one, online as well as offline. Directly after the interview, we ask to fill in the feedback questionnaire to optimise the quality of our research. We record each interview via 2 devises to guarantee that we obtain at least one recorded version. For each interview minimal 50 minutes was scheduled. However, the interviews of the residents took 60 to 90 minutes. We make an anonymised interview report of each interview according to the 7 inquiry categories of the assessment format and the accompanying in-depth questions. Before sending the draft version to the interviewee for approval, we compare each report by the given answers of the feedback questionnaire. This is the second triangulation step. For security reasons, the online feedback questionnaire is created via the LimeSurvey application of the OU to safeguard the identity and data of the respondents. In case of a face-to-face interview, we kindly ask the respondent to fill in a paper-based version of the feedback questionnaire directly after the interview and hand it over to the researcher. In addition, we have agreed with the interviewees that we will erase the recorded interviews after the publication of the thesis.

In terms of interview preparation, we studied and reflected on the applied surveys and interview questions from Tromp's (2019) case studies. Based on these findings, the scope of our research and the established

2-steps triangulation of our data, we compiled the scientifically valid tailormade semi-structured survey and the accompanying feedback questionnaire.

We applied a semi-structured survey because, according to Robson (2002) and Verschuren & Doorewaard (2016) the predetermined questions whereby the order can be modified during the interview based on how the interviewee interpret and perceive the interview is to be most appropriate for our case study. First, because our research is ex-post; we ask our respondents to go back in time and dig into their memory. Second, we ask them to reflect on a process which can be perceived as a side issue regarding their main problem. And third, the context is rather politically laden. During our interview we would like to stay away from this because we aim to retrieve technical local knowledge development and the role of Lived Experience. Consequently, there is structure in our objective questioning. However, when some questions seem inappropriate with a particular respondent it can be omitted or vice-versa, a question is missing it can be included.

To ensure the validity of the interview, we designed the feedback questionnaire. This questionnaire consists of 17 closed statements to minimise the threshold for filling in. Regarding the answer possibilities, we have chosen a 4-points rating scale, with one option to choose and no mid-point. At the end of the questionnaire, we created a textbox for the interviewee to leave any comments or extra information. The results of this feedback questionnaire can verify the given responses during the interview on the 7 inquiry categories. When composing the statements, we paid attention to validity and coherence between statements and the semi-structured survey (Verschuren & Doorewaard, 2016).

To conduct the interviews, we organised 6 conversations; 3 with residents and 2 with civil servant-experts, and 1 with a civil servant-process facilitator, following the substantiated selection criteria above. Below, we enumerate the basic demographic and other general information concerning the interviewees relevant to our research. The complete datasets of our study are stored at the Open University (OU), in the Netherlands and can be requested via info@ou.nl; with the reference to the Faculty of Natural Sciences, Environmental Sciences department.

Analysing the collected demographic – and the other general data we learn that we interviewed Dutchmen only; 4 of them in the age range of 40 – 60 and 2 older than 60. One single respondent participated in a research survey before concerning the GrondwaterOpPeil (GOP) project. The residents and one civil servant were on the project from 2016 up and until 2020. Regarding the other 2 civil servants; one works on the programme from 2017 onwards and the other from 2016 up to and including 2017. All the interviews took place in week 20; from 17 up and until 21 May 2021. We conducted one interview per day, except on 21 May. That day we interviewed 2 respondents. The weather conditions during this week were quite consistent; in between 11 and 16 degrees Celsius, a little sun, cloudy and some wind. However, 19 May it was rainy.

To analyse the data of the semi-structured interviews, we study the final interview reports and coded the agreed text. We did this conform the comparison analysis we applied during the document study including the further questions of the interim result of the document study. Subsequently, we describe the comprehensive results in paragraph 5.2. and the analysis in 5.3.

4.2.3 Data quality

The reason for qualitative research is often to provide in-depth understanding of certain phenomena, according to Baxter & Jack (2012) and Robson (2002). The objective of our study is to provide in-depth understanding of the phenomena Lived Experience for sustainable water management and how to obtain local knowledge elements or types by action learning of the participants.

Our qualitative research has 4 peculiar means to ensure the integrity and robustness of its data; i) trustworthiness, ii) validity, iii) applicability and iv) consistency (Hammarberg, Kirkman, & de Lacey, 2016; Verschuren & Doorewaard, 2016). Concerning trustworthiness, the performance of the case study opts to be as transparent as possible by discoursing the purpose of the research, detailed discussion and description how each step of the mixed method, and why certain procedures were chosen (Hammarberg, Kirkman, & de Lacey, 2016). In our research we tried to be as transparent as possible by clearly stating the purpose of the research, describing how the research was conducted and how certain procedural decision were made. This in close consultation with peer debriefing and member checking of the interim results and the interview reports (Verschuren & Doorewaard, 2016).

Secondly, the research is validated when the results are deemed to be believable. The techniques of the mixed method approach have been undertaken to ensure the validity of this case study including a 2-step triangulation (Robson, 2002, pp. 483 - 485). Furthermore, a comprehensive description of the data interpretation process is included, plus verbatim quotes from the interviewees (Hammarberg, Kirkman, & de Lacey, 2016).

The third criterion in qualitative research is the applicability or transferability of the research, which evaluates the external validity. This evaluates to what degree the results can be transferred to other contexts or is ‘generalizable’. The sample size of this research concerning the document study is on average and the selection method is explained. Some of the selected documents were tracked in the data supply of the municipality and via the website of the residents’ group. The sample size of the interviews is relatively small. Hence, the interviews were quite detailed. The interview report has been cross checked by the feedback questionnaire, the second triangulation step and finally agreed by the interviewees. To be able to gain transferable findings, the researcher has tried to gather sufficient validated data to reach data saturation regarding the determined research question (Hammarberg, Kirkman, & de Lacey, 2016; Verschuren & Doorewaard, 2016). Data saturation is a situation where data tend towards repetition or where data cease to offer new directions and raise new questions (Verschuren & Doorewaard, 2016).

Fourth, the criterion consistency can defend the integrity of qualitative research, which is the reliability. The research is consistent when different researchers would obtain the same data and reach the same conclusions after analysing the data (Verschuren & Doorewaard, 2016). The researcher acknowledges that she tried to conduct the interviews in the same way as much as possible. She even wore the same outfit during every interview. However, another interviewer applying the same semi-structured survey under the same conditions could retrieve other results. This is one of the limitations of this research. In addition, the researcher has tried to be consistent by comparing the data consequently in the different phases of the study via the determined assessment format based on scientific articles and literature.

4.2.4 Ethical considerations

In social research based on an environmental issue, ethics must be considered between 'right to know' of the researcher and 'right to privacy, dignity and self-determination' of the research participants i.e., the expert key persons and the interviewees. In general, ethics refers to rules of conduct; typically, to conformity to a code or set of principles (Robson, 2002, p. 65). As part of the code of conduct regarding research ethics is embedded in the GDPR-act. Herewith, we guarantee the anonymity of interviewees and the actors mentioned in de studied documents. The confidential information e.g., actor code, male/female, age and number of months involved with the groundwater programme Rotterdam-Hillegersberg will be stored safekept at the OU and excluded in the public reports or annexes.

The contact person of the municipality of Rotterdam invited the interviewees to partake in this research. In the invitation, which was the same for everyone, he underlined the independence of the researcher. The interviewees participated voluntarily without remuneration. There was also no hierarchical relation between the actors mentioned in the documents neither of the interviewees with the researcher. The research has been conducted for a master thesis. No commercial, financial or political interest has been exerted in the performance of the investigation.

Chapter 5 Results

Here we present the results and analysis of the data we have retrieved during our research. In paragraph 5.1 we explain the 7 inquiry categories of our assessment format to answer our research questions based on the theoretical concept. Following, we expound on the outcome of the document study and the interviews. In the final paragraph, we summarise and analyse the findings regarding the applied research design of our case study.

5.1 Literature research results

Based on the research variables determined in paragraph 4.1.2., we reviewed the relevant literature. Upon our substantiated findings, we discoursed with the supervisor, external co-assessor, and the 3 involved expert key persons of the Rotterdam municipality on the formulation of these variables and how to translate this into the assessment format. Below we list the variables which are the basis of our study to answer the determined research questions (Baarda, 2014; Verschuren & Doorewaard, 2016).

The key independent (1 and 2) and dependent (3) variables are the following inquiry categories:

1. the cause of the (local) knowledge development for sustainability;
2. the process to apply collective action learning involving Lived Experience;
3. the types of knowledge development originated through Lived Experience.

Furthermore, the following mediating variables are the next 3 inquiry categories of our study:

4. the barriers in the communication process;
5. the characteristics of trust;
6. the components of power.

Finally, the last inquiry category and also a key dependent variable is:

7. the possible uptake of local knowledge to complement (scientific) knowledge considering the Lived Experience for Sustainable Water Management.

In the following step, these variables are transferred to the assessment format in the columns 1 and 2, as shown in Table 1 below. Furthermore, we discussed respectively what issues we aim to answer and via which components we aspire to detect the answers in words and/or phrases per inquiry category (Foucault & Gordon, 1980; Kolb & Kolb, 2009; Tromp, 2019; Wilson, 2012). These issues and components are listed in the columns 3 and 4 of Table 1. We also used the components as a guideline for coding and analysing the data, regarding the selected documents and the semi-structured interviews. In addition, we assessed these inquiry categories on behalf of the 3 determined actor groups.

Table 1. Assessment format to analyse the variables in the selected documents and the semi-structured interviews to answer the determined research questions of the study; knowledge uptake from Lived Experience to complement scientific knowledge in urban policymaking regarding sustainable water management.

nr	Inquiry category	Inquiry - issue	Inquiry – component(s)
1	The cause for the (local) knowledge development for sustainability	The reason to start the communication process	The proximate influence defined and agreed (Wilson, 2012)
2	Action learning	The process of (collective) action learning in the Lived Experience holistic approach	Experiential Learning Theory: experiencing, reflecting, thinking and acting And mutual learning (Kolb & Kolb, 2009)
3	The local knowledge development types regarding LE_SWM	The types of knowledge development originated through Lived Experience of residents	Input of Lived Experience And local knowledge (Wilson, 2012)
4	Communication process	The barriers in the communication process	Transmission barriers, e.g., timing and location of the meetings, language use, noise nuisance, insufficient communication - and/or representation skills Cognitive barriers Psychological barriers (Tromp, 2019)

Continuation of Table 1

nr	Inquiry category	Inquiry - issue	Inquiry – component(s)
5	Trust	The characteristics of trust	Benevolent-based trust; sender intrinsically sincere is interested in the collective action learning process and to share knowledge. And competence-based trust; the belief that the sender is an expert concerning the subject Interpersonal trust (Tromp, 2019)
6	Power	Modes of exercising power	Governmentality; the State knows its residents and their needs (Foucault & Gordon, 1980)
7	The possible uptake of local knowledge to complement (scientific) knowledge development considering the LE_SWM approach	The possible (failure) mechanisms to uptake the local knowledge developed including Lived Experience as a result of the collective action learning process	Local knowledge including LE uptake in the execution, urban policymaking, and scientific knowledge development Possible failure mechanism; strategic power play

			(Tromp, 2019)

5.2 Document study and interview results

5.2.1 Introduction to the data results

In this section, we report the data collection of the document study and the interviews. As a result of the document study, we made an overview of all relevant events in the time lap 2016 – 2020, see Figure 8. This timeline serves as a guide while reading paragraph 5.2.2. In this paragraph, we first share the summary of the both researches per inquiry category, see Table 2. Following, we describe the results of the document study and the semi-structured interviews per inquiry category in an edited version because of the translation from Dutch to English and to improve the readability. In paragraph 5.3, we show the summary of the overall results per inquiry category in Table 3 and our analysis of the results per dataset.

In addition, we reported the findings of the initial results of the document study in Annex I, the Interim Report of the Document Study. The outcome of the feedback questionnaire for the triangulation of the semi-structured interviews is exposed in Annex II. We stored the full datasets of the filled-in assessment formats of the document study and interview results, and the agreed and coded reports of the semi-structured interview results at the Open University (OU), in the Netherlands, as explained in paragraph 4.2.

CASE STUDY **KNOWLEDGE UPTAKE FROM LIVED EXPERIENCE TO COMPLEMENT SCIENTIFIC KNOWLEDGE IN URBAN POLICYMAKING REGARDING SUSTAINABLE WATER MANAGEMENT**

HISTORY

Low groundwater level a structural problem in the Bloemenbuurt since 2005.

Local knowledge development incl. LE (I): Residents are measuring monitoring wells in public area Bloemenbuurt since 2015.

Monthly workgroup meeting with residents and civil servants concerning the foundations of the houses.

2016

APR — SEP

APRIL – SEPT, DI SYSTEM INSTALLED IN BLOEMENBUURT EAST DURING SEWER REPLACEMENT

SEPT 2016 – MAY 2017, DRAINAGE AND INFILTRATION SYSTEM (DI SYSTEM)

JAN

ROTTERDAM MUNICIPALITY

Authorities plan to scale up administrative agreements with the residents and included all the districts in Hillegersberg foundation-risk area.

MAR

Contact persons meeting of the GGF project concerning groundwater level regulation.

APR

Local knowledge development incl. LE (I): Residents start measuring monitoring wells on private property in Bloemenbuurt.

LOCAL KNOWLEDGE INCL. LE

MAY

Letter from the Alderman to residents of the foundation-risk area Hillegersberg explaining the plan of approach and clarifying the roles; without any hard agreements or arrangements.

JUN

The authorities and various residents' organisations of the foundation-risk area Hillegersberg have a constructive discussions about groundwater concerning foundation problems.
They settled the updated administrative agreements.

News article 'Rotterdam dreigt met sloop woningen Margrietstraat' at Rijnmond website (Rijnmond, 2016).

AD newspaper article 'Fonds voor reparatie bij paalrot', see Annex IV.

SEP

Resident speaks on behalf of the GGF project at the City Council committee meeting. Result;
2 political parties endorsed the motion to release funding for the required pump. The so-called 'motie pomp'.

OCT

However, also a pressure pipe is required to guide surface water via the DI system to the Bloemenbuurt.

NOV

Local knowledge development incl. LE (II): Resident introduces the idea to pump the pumped-up groundwater into the DI system.
The contractor and the municipality agreed. The groundwater level increased during the weekend. Hence, the test succeeded.

Resident shows politicians around the Bloemenbuurt.

2018

JUN — NOV

T= 0 MEASUREMENTS: BEFORE THE PUMP EXPERIMENT IS OPERATIONAL FROM NOV 2017 – OCT 2018

START T=1 MEASUREMENTS: PUMP EXPERIMENT FROM NOV 2018 – DEC 2019

HISTORICAL DROUGHT DURING THE SUMMER (Stowa, n.d.)

FEB

Symbolic start of work on the pump and pressure pipeline.

ROTTERDAM MUNICIPALITY

New area director of the municipality adjusts the administrative consultation structure between the authorities and the residents.

APR

Residents' meeting in the Orange Church.

OCT

22 October, the pump runs its first test.

NOV

Commissioning of the pump for the pilot and a residents' meeting afterwards.

News article 'Kleiwegkwartier pompt water uit de singel onder huizen tegen paalrot' at Rijnmond website (Rijnmond, 2018).

2019

APR

JAN

ROTTERDAM MUNICIPALITY

Start preperation of the future supply of surface water by gravity; constructing an underground pipe at the Kleiweg/Uitweg intersection.

Figure 8. Infographic timeline of the most significant events and outcomes of the GOP project Bloemenbuurt - groundwater programme Rotterdam-Hillegersberg case, in the presented research.

LEGEND

- Relevant weather conditions or other external events
- Actions of the municipality (execution work or process facilitation)
- Meetings
- Monthly workgroup meetings revealed during the interviews
- Local knowledge development incl. LE
- Document + interview results on local knowledge development incl. LE

2017

JUN — NOV

INSTALLED IN THE BLOEMENBUURT WEST DURING SEWER REPLACEMENT

START T= 0 MEASUREMENTS

FEB

ROTTERDAM MUNICIPALITY

The municipality announces to compose a workgroup with residents.
The first meeting was planned on 22 March 2017.

MAR

It subsequently emerged that the Alderman had already sent a 'Plan of approach to groundwater and foundations' to the City Council. Residents were not informed. This plan goes against part of the residents' master plan.

Local knowledge development incl. LE (II): Resident disconnects the rainwater discharge from the sewers and installs an infiltration system in his garden.

Residents' meeting with 250 attendees at Lommerrijk with the authorities. Residents present masterplan Sustainable Groundwater Management including pump + pressure pipeline experiment Bloemenbuurt. The Alderman supports this experiment.

As of March 2017, monthly a workgroup meeting with residents and civil servants is reactivated by the civil servant-process facilitator.

ACTION LEARNING

MAY

Local knowledge development incl. LE (III): Residents present the report 'Monitoring groundwater level - experiments by residents' to the Alderman.

JUL

13-15 JULY, VERY HEAVY RAINFALL

The City Council request to present an outline for a 'Rotterdam Groundwater Delta Plan', detailing how residents groups, the RWA (HHSK), and groundwater experts can be involved.

Local knowledge development incl. LE (II): Residents establish the GrondwaterOpPeil project.

SEP

15-16 SEP, VERY HEAVY RAINFALL

Local knowledge development incl. LE (II): after heavy rainfall, the cycle path flooded near the Rozenlaan bridge. Resident notices that sewers could not keep up and learns that the wells on Rozenlaan are not connected to the DI system. Result; rainwater flushes away.

OCT

The civil servant (key person) confirms that the supply of surface water will be carried out shortly with a pump and pressure pipe to the DI system in Akkerwindestraat. It should be operational before the summer of 2018. 'In the coming years, we monitor the groundwater level.'

Local knowledge development incl. LE (II): the difference in groundwater level in Bloemenbuurt East and West can be explained by works on the RET terrain, where groundwater is pumped away. This can have a temporary influence, especially in Zonnebloemstraat.

ACTION LEARNING

Residents' meeting on 4 October with 130 attendees at the Orange Church. Additional information exchange during this meeting concerning the optimalisation of the groundwater table and subsidence effects.

NOV

Local knowledge development incl. LE (II): Resident discovers that in Orchideestraat an overflow pit is dimensioned at NAP - 2.94 m, instead of -2.65 m. The municipality decommissioned this overflow.

DEC

ALLY LOW GROUNDWATER LEVELS IN NL + 2ND YEAR OF DROUGHT DURING THE SUMMER (KNMI, n.d.)

SEP

Local knowledge development incl. LE (III): Municipality takes over field monitoring wells measuring activities from external contractor. The next step is to equip a quarter of all municipal monitoring wells (2,000 in total) with an automatic logger.

LOCAL KNOWLEDGE INCL. LE

DEC

Residents' meeting information exchange on the state of affairs and the discussion concerning the preliminary final report GOP project/pump experiment.

Local knowledge development incl. LE (III): The report is rejected by the residents. Fierce discussion about the effect of the pump.

2020

MAR

CORONA PANDEMIC OUTBREAK IN THE NETHERLANDS

JAN

ROTTERDAM MUNICIPALITY

Start 'Process of implementing groundwater policy in foundation-risk area Hillegersberg'.

FEB

Administrative consultation of the pump experiment, documented by the residents in a report of the meeting (In Hillegersberg, 2020).

MAY

Rotterdam Court of Audit issues the report 'Burgers op de Bres' including the GrondwaterOpPeil project.
(Rotterdam Court of Audit Report, 2020 pp. 137 - 160)

End of case study timeline.

5.2.2 Results of the document study and the semi-structured interviews per inquiry category

Table 2. Summary of the document - and interview results per inquiry category.

nr	Inquiry category	Results document study	Results interviews and feedback questionnaires
1	The cause for the (local) knowledge development for sustainability	The 3 actor groups did not mention a clear common cause in the documents.	The semi-structured interviews revealed that groundwater management was the main reason for taking action.
2	Action learning	We were unable to locate in the documents where and how action learning processes were carried out and how knowledge development including local experience, came about.	The residents explained the action learning by discussing the completeness and correctness of the possible solutions in the monthly workgroup meetings. Questions were asked e.g., what information have we gathered, how are we going to interpret the information, and what more information and expertise is needed? Furthermore, they learned from their monitoring wells measurements, by walking around in the Bloemenbuurt and talking with the workers in the public area. They reported per email to the civil servant-experts the incorrect executions of the work that influenced groundwater level. The civil servants learned in the same workgroup meetings and via the measurements and observations of the residents in the field. They say; 'the residents are their eyes and ears in the field.' The civil servant-process facilitator indicate that they were not that conscious of the possible effect of the learning processes. Afterwards, he realizes that he probably did not pay enough attention to it.
3	The local knowledge development elements regarding LE_SWM	The document data revealed 3 types of local knowledge development: I) residents measure monitoring wells in the public area and on private premises; II) Lived Experience (the eyes and ears in the field); and III) development of local knowledge by experimenting together.	The residents confirmed the monitoring wells measurements (I) and that nowadays before and during the execution of the work the residents are involved (II). It is clear that they are the eyes and ears in the field. They state that obtained knowledge by walking around and exchanging of experiences of the residents (II) the local knowledge has certainly been picked up by the civil servants. The civil servant-experts conclude that more and improved data has been obtained from the monitoring wells measurements, the overflow pit observations and the DI system measurements of the residents (I). Furthermore, they underline that the residents can link the data directly to the specific observations (II) in the Bloemenbuurt. This is of extra value and improves the area specific knowledge on how to optimise maintenance work in the district. The civil servant-experts explain that the test with the pump, which was pushed by the residents, has clarified that the groundwater level in the Bloemenbuurt can be increased artificially (III).
4	Communication process	Suggestive written language in some of the documents referring to unclear information and knowledge sharing e.g., the ambiguity and the unspoken assumptions of the agreement on the solution and the decisions of 'motie pomp'.	Concerning the communication process, the residents and civil servants agreed that in the workgroup meetings was enough time and room for questions and dialogue. However, in the interviews with the residents the **transmission barrier language use** occurred. The residents did not always understand the civil servant-experts because they use difficult words and complex sentences to communicate (bureaucratic jargon). In addition, we learned in the interview dataset that the civil servant-experts did **not possess sufficient communication skills, another transmission barrier.** This was unveiled by the mismanagement of agreements, not communicate about changes or delays, lack of preparation of the meetings, insufficient presentation skills and lack of ability to ask further questions. Furthermore, the **psychological barrier cognitive dissonance** appeared in the data. The residents explained this stagnation of the communication due to the ongoing dispute concerning 'motie pomp' versus the free decay option. The civil servant-process facilitator intervened if the way of communicating made participants uncomfortable or even unsafe.
5	Trust	In the documents, we read signs of trust and mistrust from predominantly the residents towards the civil servants and the Rotterdam municipality.	Regarding **competence-based trust**, both actor groups **perceive each other as experts**. Concerning **benevolent trust**, the residents felt that the civil servants were **withholding information throughout the process**. The residents did not and still do not belief that the civil servants are intrinsically sincerely interested in the collective action learning process and to share the available knowledge. However, the civil servant experts involved on the GOP project feel that the benevolent trust has accrued over the time; by building on the (trust) relations, learning to speak each other's language, and exchange technical information and experiences of the monitoring wells measurements.

Continuation of Table 2

nr	Inquiry category	Results document study	Results interviews and feedback questionnaires
			Regarding one interviewed resident, the **interpersonal trust relation is irreversible damaged between him and some civil servants.** He felt personally offended. His expectation (refund of his payment upfront for equipment) and his values (do not share information without permission of the residents) were neglected.
6	Power	Concerning power, the dataset suggests that the Alderman claims to understand the residents and that he will meet their requirements. Which subsequently creates an almost impossible task for civil servants. The residents manifest their (collective) strength enforcing 'motie pomp' via politics.	The residents experience that the Aldermen and City Council understand them and know what the residents want. However, from the interview data can be retrieved that the **civil servants most likely have the attitude and behaviour of knowing in general what is best for all the residents, explained by Foucault**. Moreover, in this case study, the power element is much more an element of **strategic power play mechanism obstructing the knowledge uptake**, defined by Tromp (2019). The residents perceive strategic power play by the civil servants because they vindicate the policy and without informing the residents, act as planned. And the civil servants note that when the residents' interests are not involved in decision-making, they escalate to the City Council and Aldermen. According to the civil servants, the residents are **well organised in the GOP project and via politics they can overrule the policy. This can be perceived as an element of strategic power play.** In our data, a resident mentions the role of the media as a component of trust. The civil servant categorises the role of the media as a power element.
7	The possible uptake of local knowledge to complement (scientific) knowledge development considering LE_SWM	The action of the resident to return the pumped groundwater via the DI system to the groundwater reservoir is a tangible example of Lived Experience that has been directly incorporated into the execution (II). However, if and how the monitoring wells measurements and the developed local knowledge concerning 'motie pomp' are included in urban policymaking and relevant for scientific knowledge development cannot be found in the selected documents.	The interviewees unanimously agreed that the monitoring wells measurements (I) of the residents and the observations in the area, being Lived Experience (II), added value to the execution work in the field of the municipality of Rotterdam. In addition, the civil servant-expert in charge of the monitoring wells network in the Rotterdam municipality took over the measurement operations and strived to equip a quarter of all municipal monitoring wells with an automatic logger. The residents consider that the developed local knowledge is not taken into account in the urban policymaking concerning the Municipal Sewerage Plan-5 (Gemeentelijk Rioleringsplan-5, GRP5). The civil servant clarifies that the current policy document GRP5 is not that strict in solely water infiltration under gravity than the previous one. Without reasoned explanation, the civil servant-experts and one resident state that it can take years before a request for change like this will be embedded in the policy. Regarding the (monitoring wells) measurements of the residents, the interviewees agree that this can be of value for scientific knowledge development that can be taken into account in urban policymaking. Therefore, the residents and civil servant-experts started to discuss to validate the available monitoring wells measurement data, see Annex III. However, in the evaluation report of the GOP project including the validation of measurement data, we could not find e.g., the measurement method of both actor groups nor the process of installing and maintaining the wells. Further research is needed to define if this data including the method will be valuable for scientific knowledge development regarding sustainable water management. Thus, collecting data to enrich scientific knowledge development might be possible. However, it requires thorough and specific knowledge of the scientific subject and how to construct new scientific knowledge of the participants.

Inquiry category 1: The cause for the (local) knowledge development for sustainability

Document study results

Although the documents unveil that the Bloemenbuurt is suffering from a structural low groundwater level since 2005 and residents are measuring monitoring wells in the public area since 2015, as shown in Figure 8, we did not find in the dataset that the 3 actor groups have a clear common reason to proceed to conscious mutual learning for the same sustainable development issue. The possible proximate influence did not become clear in the texts. However, we must keep in mind that the documents were not written for the purpose of this research.

Interview and feedback questionnaire results

The interview data exposed that out of the 6 respondents, 4 unanimously answered during the interview and via the feedback survey that the cause for this project was groundwater management. One resident ticked also the box ‘sustainable development of the living environment’ in the feedback questionnaire. Another resident referred in his interview to the unspoken and non-transparent financial consequences of slow-moving catastrophe of pile rot in foundations of the houses in combination with a too low groundwater table. Most probably encouraged by the invitation and semi-structured questioning during the interviews, the common cause being the groundwater management problem, became clear.

Inquiry category 2: The process to apply collective action learning involving Lived Experience

Document study results

While constructing the timeline, we detected 5 residents’ meetings, and one contact persons meeting during 2016 – 2020, see Figure 8. The minutes of the steering - and the programme group referred to several other municipality meetings within the timeframe of our case study. Nonetheless, we could not localise in these meeting reports how the learning processes has been enacted, and how local knowledge development including local experiences was constructed. We also hardly could detect action learning in the selected document set. We only traced 2 quotes of residents of the foundation-risk area Hillegersberg revealing some kind of learning; 'both parties have learned a lot' and ‘everyone’s expertise is needed.'

Interview and feedback questionnaire results

To ask the respondents at which meetings they attended, 3 of them confirmed the 5 resident’s meetings during 2016 – 2020, as shown in Figure 8. These meetings were facilitated by the municipality of Rotterdam and organized by the residents. The predominant goal of these meetings was to inform all the affected residents in the Bloemenbuurt and other neighbourhoods in the foundation-risk area Hillegersberg. Regarding our research question; no specific action learning and local knowledge development including Lived Experience retrieval processes most probably took place at these residents' meetings, according to the respondents.

As in the document study, the respondents were not coherent about the name and scope of the meetings and the projects. During 2016, 2 interviewed residents were already engaged in the GoedGefundeerd project, the predecessor of the GrondwaterOpPeil project (GOP project). The GOP project was formalised in July 2017 and one of the interviewed residents took over the chairmanship, see Figure 8.

He adds that since 2016, he participated approximately once a month in what he calls the workgroup with residents and civil servants. In this workgroup, the participants exchanged experiences and knowledge regarding the groundwater level in the Bloemenbuurt, as shown in Figure 8. He corroborates in his interview that the collective action learning process took place during the workgroup meetings by discussing the completeness and correctness of the possible solutions (Kolb & Kolb, 2009; Wilson, 2012). In these workgroup meetings, questions were asked e.g., what information have we

gathered, how are we going to interpret the information, and what more information and expertise is needed? Twice, he took City Councillors on a guided tour in the Bloemenbuurt, see Figure 8. ‘This way they got an idea of what is going on', he adds.

In the beginning of 2017, the interviewed civil servant-process facilitator, re-institutionalised the groundwater programme Rotterdam-Hillegersberg meeting structure. In addition, while working in the field, he quickly unraveled the need of urgency among the residents and their persuasion to solve this problem not only for the Bloemenbuurt but also for other districts in Rotterdam. In the interview data his remark can be linked to the responses of the Bloemenbuurt residents. He confirms that solely in the monthly workgroup meeting with residents and civil servants, the learning took place. ‘In these meetings, they deliberated on the findings, asked questions, and exchanged knowledge regarding the sustainable development of groundwater management’, he adds. All the participants of the workgroup were aware of what he calls ‘the knowledge improvement process’ and their collective goal ‘to create solutions for our city together'. He helped the residents to put their need of urgency on the table by asking what was their worst nightmare. Hence, he installed this discussion table mainly to establish relationships and to learn to understand each other.

Furthermore, the respondents indicated that there were various other meetings, other workgroups in the Bloemenbuurt while execution work took place, and a lot of email traffic and calls between the residents and civil servants. One interviewed resident stated that he learned the most by walking around in the Bloemenbuurt and via talks with the workers in the public area. He reported per email to the civil servants the incorrect executions of the work that influenced the groundwater level.

This we explain as the concept of Lived Experience, according to Abbott & Wilson (2015) and requires thinking in systems to solve the multifaceted problem of, in our case study, the groundwater management in a district. We observed that this resident started to think about his house, the houses in the street, in the district, Rotterdam and the rest of the Netherlands. He learned what is already known to others and further developed existing capabilities through his cognitive interests (Wilson, 2012). In addition, we link this to what Kolb & Kolb (2009) underwrite as action learning by clarifying learning as the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience’. They labelled this as the Experiential Learning Theory. This interviewee presented this in his interview.

This resident started with the help of other residents, to measure and archive the data of the public monitoring wells in the Bloemenbuurt since 2015. Gradually over time, they also started measuring overflow pits and the DI system in the public area, and the monitoring wells which they installed on private property in the Bloemenbuurt since April 2016, see Figure 8. In addition to these learning activities, he also had telephone and email consultations with the civil servant-experts. ‘In the beginning, the contacts were even very intensive’, he said. He saw failures during the execution of the sewer renewal and repaving in the Bloemenbuurt, during 2016- 2017, see Figure 8. He discussed with the work performers how these incorrect executions could be prevented, i.e., the alternation he suggested to reroute the DI system in the Zonnebloemstraat. He said, ‘I felt recognised and to me it was learning’.

One of the most memorable examples which is also mentioned in the document study results, is that he convinced the workers to perform a test during a weekend in November 2016, to allow the pumped

groundwater into the DI system instead of the sewage system. Over the weekend, the groundwater table accrued gradually and remained stable due to this intervention. For him this was the proof of concept that a pump was a worthwhile solution for the Bloemenbuurt. He reasoned this by studying the measurement data of the monitoring wells, see Figure 8.

Continuing on the monitoring wells measurements he adds; ‘we execute and collect manual measurements of the public monitoring wells 3 times a week, at the same day, on the same time, since 2015. The private monitoring wells, we measure every week, since April 2016. Our measurement can be trusted’. The municipality has only a few monitoring wells in this district. Some with automatic loggers, measuring permanently, he continues. He discovered that a few loggers malfunctioned from time to time. He noticed that in some cases the batteries were dead or the loggers did not work properly because a car was parked on top. ‘In case it is a Tesla, the logger doesn't work at all’, he adds.

Another interviewed respondent, a retired geohydrologist, shares that he enjoys discussions with the workers and needs to be convinced by facts and arguments. 'If there was something which they could not clarify, they called me. With my bike, I am on-site within 10 minutes. I want to see and understand the groundwater system down to the smallest detail.’ He adds that the workers were often very eager to exchange information to increase the quality of their work. To him, this is ‘action learning’ and it goes fast.

The civil servant-experts appreciated the learning and developing knowledge in the workgroup. They underline that in these meetings they try to come to an understanding, despite the different opinions and interests. They acknowledge that some residents were and still are actively collecting data and that the municipality learns from these monitoring wells measurements. ‘It occurred that the measurements of the municipality in public area were not accurate for various reasons’, they corroborate. ‘Furthermore, the measurements of the residents are very helpful to obtain more knowledgeable insights of the water and subsoil system of the district.’

Next to the meetings and the measurements, they experience that the residents are ‘their eyes and ears in the area’. The residents report omissions and issues to the them, preferably via email, e.g., operational issues as malfunctioning of the pump, overflow of sewage pits, and inaccuracies or even mistakes during the execution of sewage work. In response, the civil servant-experts take appropriate actions on that. However, they explain that they have to take care of public and private interests on behalf of the municipality, i.e., they aim to do what is good for the city and its citizens. Whereas the residents usually solely focus on their concerns in their district. Or they want to enforce a modification which is not a standard default, e.g., a filter in front of the pump water intake. ‘Mutual learning and local knowledge development are not per se an obstacle. However, different interests can block the collective learning process’, the civil servant-experts state.

All interviewees underline that eventually, they have learned collectively. However, in retrospective, too limited since the learning element was not sufficiently acknowledged by the participants. Albeit, they clarify that they developed and performed experiments together and that once they got to know each other, everyone’s input was valuable, see Figure 8. However, in the end, to implement active groundwater management via a pump as one of the standard options was a no-go area for the civil servant-experts.

Inquiry category 3: The local knowledge development originated through Lived Experience of the residents

Document study results

The document study results connect to the Rotterdam Court of Audit report 'Burgers op de Bres', May 2020, which also studied the GOP project. We mark 3 types of local knowledge development including Lived Experience activities in the document data, situated in time, shown in Figure 8.

The first type (I) is the initiative of the Bloemenbuurt residents to measure the groundwater level via the monitoring wells. This tends towards the contemporary term ‘citizens science’ in which measurements of residents in consultation with the experts, can lead to joint construction of knowledge.

The second type (II) is Lived Experience and local knowledge of residents in the area. In our document data, this includes the 2 actions of one resident. First, he urged to discharge the pumped groundwater back into the natural groundwater reservoir via the drainage and infiltration system (DI system) during sewage works in the Bloemenbuurt. After this successful test, the data shows that this action is also included in the execution (inquiry category 7). Second, R2 disconnected the rainwater discharge at his private property from the sewer and let the rain infiltrate in his garden. The other 2 action learning activities mentioned in the Rotterdam Court of Audit report by Bosch & van der Greft (2020) also refer to this type of local knowledge development. First, the Bloemenbuurt residents noticed that an overflow pit had been constructed incorrectly. And second, after investigation they uncovered that no drainage sand had been used to create a sand-bed under the sewer with spigots for groundwater level improvement. This latter turned out to be a design failure and was adjusted in the master design directly (inquiry category 7).

The last type (III) is the mutual development of local knowledge including Lived Experience by experimenting. Herewith we indicate the combination of the input of local experience, historical knowledge of the area, and the expertise of residents and civil servant-experts to restore the stability of the foundations by increasing the groundwater level to stop pile rot. In our document dataset, this local knowledge development is often referred to as 'motie pomp', as shown in Figure 8 (September 2016).

Interview and feedback questionnaire results

The residents already expounded on their monitoring wells measurements (I) in inquiry category 2. Furthermore, they corroborate the developed local knowledge (II) by observations in the field, with or without reasoning with the implementers in the area. The interviewed residents are curious to learn for sustainable development for the common good and are eager to maintain the social cohesion in the Bloemenbuurt. They analyse their monitoring wells measurements (I) and study situations affecting the groundwater table in the area (II). Step by step, they learned how to tackle each problem e.g., the decreasing groundwater table around an apartment building in the Elektroweg and practicalities as disconnecting rainwater discharge form the sewage and let it infiltrate on their premises, as shown in Figure 8. Once they found the cause and the solution was embedded, one of the residents writes a short report and finishes the task. They share the developed area-specific knowledge via the website, in the neighbourhood newspaper, or other frequently used communication channels in the Bloemenbuurt. They

also gathered knowledge about the history of the area and the development of its local water and subsoil system. This and other obtained knowledge concerning the groundwater management of the Bloemenbuurt, they recorded in the final evaluation report of the GOP project.

One of the interviewed residents explain that in short, everything is connected. ‘So basically, we, as residents, want to manage water in our district together with the municipality (III).’ He corroborates this statement with the example that when the streets in the neighbourhood were elevated by the municipality, the house owners had to take care of raising their front and back yards. If the house owners did not take action in combination with natural subsidence it could lead to wetter gardens in some cases. A few residents were even affected by waterlogging around the house and therefore installed a pump; the result is lowering the groundwater level in the surrounding of the installed pump.

Both interviewed civil servant-experts conclude that more and improved data has been obtained from the monitoring wells measurements, the overflow pit observations, and the DI system measurements by the residents (I). Furthermore, they underline that the residents can link the data directly to the specific observations in the Bloemenbuurt (II), e.g., flooding of the cycle tracks or clogged street wells after heavy rainfall, see Figure 8. This adds value and improves the specific knowledge on how to optimise maintenance work in the district, the civil servants clarify. As a result, they currently install sounding board groups involving residents before and during execution works.

The civil servant-experts also explain that the knowledge of Oud-Hillegersberg about water infiltration has been considered and included in the pump and pressure pipe experiment applied in the Bloemenbuurt. The experiment with the pump illustrated that the groundwater level in the Bloemenbuurt can be increased artificially. This local knowledge was developed because the residents pushed for the pilot with the pump via the politics, the so-called ‘motie pomp’ (III), according to the civil servant-experts. They underline that over time with the validated monitoring wells measurement data new knowledge has been developed concerning groundwater management and the subsoil of the Bloemenbuurt e.g., that same water level in the DI system results in different groundwater levels along the entire DI system, depending on the subsurface (III).

Inquiry category 4: The barriers in the communication process

Document study results

We grasped an idea of how the communication process went while we studied in chronological order the minutes of the meetings, project documents, emails, presentations, engineering reports and the other selected documents. We marked suggestive written language, which we found in the documents. What caught our eye is the ambiguity and the unspoken assumptions concerning the 'motie pomp' experiment. We noticed by the language used in the documents, that the Alderman and the civil servants were talking about an innovative pilot with the pump, which would be in any case temporary in nature. The Rotterdam municipality prefers the planned option with free decay of surface water from the water body which, in this case, would run via a DI pipe underneath the intersection Uitweg-Kleiweg towards the Bloemenbuurt to replenish the groundwater level in this area. While residents seemed to assume that the pump would stay and operate when the experiment was successful. We could not discover the cause for this miscommunication in the document dataset.

Interview and feedback questionnaire results

The respondents were able to give more insights about their views on the communication process during the interviews. The residents indicated that there was always room for questions during the workgroup meetings. Nonetheless, they perceive the language of civil servants was and still is difficult and unruly. Given that we are conducting an ex-post case study and therefore not able to participate at a workgroup meeting; speaking the same language can be recognised as transmission barrier in the communication process (Tromp, 2019). In addition, the residents experienced that much of the discussion during the workgroup meetings was about why the civil servants preferred the municipality's policy regarding groundwater management. While the residents wanted to learn other effective solutions to expedite how to manage the groundwater levels. One of the interviewed residents unravels that he felt that there was a discussion at 2 levels. First, the technical level, what are the options to solve this problem? And second the political angle, what is the agreed policy and can it be reconsidered? From his perspective, the frenetically holding on to the policy of the civil servants hampered and slowed down the learning process. We noticed that this could refers to the psychological barrier, as cognitive dissonance explained by Tromp (2019). However, while performing the interviews there is still no mutual understanding why the municipality favours free decay concerning groundwater management in the Bloemenbuurt.

Another interviewed resident adds that the communication process between the municipality and the residents did not run smoothly because the civil servants failed to keep to the agreements and on top of that did not inform the residents about this on time. He exemplifies that the pump should have been installed in the spring of 2018 and the municipality did not give an update to the residents about the delay. Ultimately, it got settled. According to the resident, costlier than budgeted, badly planned, and finally, delivered in the autumn of 2018, see Figure 8. ‘Despite an action list was determined, the municipality sometimes did not or could not keep the promise and did not or forgot to inform the residents’, he argues.

We can identify this example as another transmission barrier; insufficient communication skills of the sender and/or receiver, also explained by Tromp (2019).

The civil servant-experts agree that specifically in the beginning, the communication process was complex. ‘We felt like we were opposites rather than partners collaborating on the same issue. In the end, by the commissioning of the pump, we learned and experimented together’, one of them said. The other civil servant declares that he as far as possible responds and gives feedback upon questions. Also, to the questions during the work group meetings. ‘Albeit, we must manage expectations’, he warns, ‘some issues cannot be solved within an hour’.

Furthermore, the civil servants also experience that the residents can say what they want and that the civil servants must remain polite. They add, that over time they have improved their listening skills and their ability to ask the question behind the question. As a result, they speak the language of the residents and learn how to exchange knowledge, according to the civil servants. However, during the interviews we noticed that still the related topics e.g., social cohesion in the Bloemenbuurt, subsidence, the water distribution issue during extreme droughts, and other effects of climate change, show that residents and civil servants do not ask each other the right questions and thus do not share the available information. Herewith we underline the transmission barriers language use and the insufficient communication skills, mentioned by Tromp (2019).

In addition to insufficient communication skills, one of the civil servants marks himself as not such a good presenter. Moreover, he thinks that he is often inadequate assertive in answering questions during meetings. He is a specialist and possesses a lot of information. He feels it is his responsibility to share the information and knowledge of the municipality. However, he is not comfortable in meetings, specifically not at the residents’ meetings. Regarding this situation at hand, we may underpin that insufficient communication - and/or presentation skills to share the knowledge is a transmission barrier. Furthermore, the other civil servant-expert had to present the first evaluation report of the GOP project including the results of the ‘motie pomp’ experiment at the residents’ meeting December 2019, see Figure 8. ‘Looking back, we should have coordinated the agenda better in advance because the same story was told twice,' he shares during the interview. By this example, we can corroborate that also inadequate preparation can hamper knowledge transfer.

The external independent consultant guiding the first phase of the GOP project was very helpful in some situations, according to one of the civil servant-experts. Albeit, this consultant was more and more siding at the residents during the process and therefore lost his impartiality. Hereafter, a colleague of District management (Gebiedsbeheer) guided the GOP project. He does not know why she left the project.

The civil servant-process facilitator reveals that the residents sometimes played the man instead of the ball during the workgroup meetings. ‘The participants did not always listen to each other carefully. Besides, in some situations, there was a high level of disagreement between participants. Different reasons led to a lack of respect.’ His key aim was that the workgroup meeting participants listen to each other. ‘If the working relation improves, it will be easier to find each other on the content’, he pleads. In addition, he underlines that the municipality is open and wants to listen to its residents. On the other hand, he also wants to exemplify that the municipality has overarching responsibility for the general interest of

the entire city. Nonetheless, sometimes, participants were offended during a workgroup meeting. He discussed this with the ones involved. If the situation did not change, he replaced his colleague and reviewed with the resident. According to him, no one should be harmed, feel uncomfortable, or even unsafe. He aimed to optimise the communication process and establish the collaboration.

According to the interview data, the residents are optimistic that they reached all the Bloemenbuurt residents. However, the civil servants refute that every resident is informed about the GOP project. This conflicting perception of the number of reached residents in the Bloemenbuurt influences the communication process between the workgroup participants.

Furthermore, the experiences of the communication process vary in the interview data. The residents among themselves feel they have good communication and know how to find each other and each other's expertise in the Bloemenbuurt. The civil servants feel that the communication with the residents is not per se good however, very important. Communication among the civil servants is experienced as difficult. The Rotterdam municipality has more than 10,000 civil servants. Therefore, they state that it is hard to find each other and the required information.

Inquiry category 5: The characteristics of trust

Document study results

Regarding trust, the data indicates that reciprocal trust is assumed, e.g., the comment of the one of the interviewed residents during the resident's meeting on 30 March 2017, shown in Figure 8. He invited the municipality of Rotterdam to start the dialogue with the residents. The residents' groups will not take any legal action. He invokes the Regional Water Authority Schieland and the Krimpenerwaard (Hoogheemraadschap van Schieland en de Krimpenerwaard, HHSK), as the middle party, to make proposals to reach constructive discussions.

However, we included phrases from the documents in the assessment format under inquiry category 5, trust, which indicated that trust was not always present during the process. A quote like; 'why are the civil servants in the resistance mode to increase the groundwater table?' and the Alderman sending the 'Plan of approach to groundwater and foundations' report to the City Council on 17 March 2017, fuelled the sense of mistrust, also shown in Figure 8. Concerning this plan, the cooperating residents' groups Hillegersberg (Samenwerkende Bewonersgroepen Hillegersberg, SBH) was not informed and it appeared to be inconsistent with the SBHs Master Plan on some points. The plan was based on solely a free decay of surface water and not on a pump with a pressure pipeline as suggested in the SBH's Master Plan. And in addition, it stated that ascending the groundwater level only delays the rotting of the piles. According to the knowledge of the representation of the SBH, this assumption is false, see Annex I.

Furthermore, the auditors of the Rotterdam Court of Audit report concluded in their investigation that civil servants who delivered late or did not appear well-prepared at the various meetings, can undermine trust. This is not necessarily due to the lack of motivation of the civil servants to perform action

learning with the residents. It may also be in consequence of the ambiguities in the communication process as stated above. However, this is difficult to determine in this ex-post case study.

Interview and feedback questionnaire results

We detected signs of mistrust of the residents regarding the Rotterdam municipality in the document dataset. Therefore, we search for intrinsically sincere interest in the collective action learning process and sharing knowledge on behalf of the civil servants, clarified by Tromp (2019) as benevolent-based trust. In addition, if it occurred, we also zoomed in on the competence-based trust; in how far the participants believe that the sender is an expert concerning the subject.

Regarding competence-based trust, both actor groups perceive each other as experts. The civil servant-experts are technical engineers and understand what they are doing, according to the residents. Albeit, the resident who is a retired geohydrologist is somewhat critical. On the other hand, the residents know the area and they are the eyes and ears in the field, according to the civil servant-experts. Furthermore, the civil servant-process facilitator adds that groundwater is part of the water and soil system and cannot be managed isolated. Therefore, new subjects were added during the process and the demarcation of the project was difficult.

In the interview data, the residents underline that they mistrust the civil servants. They explain that at first side, the civil servants did not clarify why they could not collaborate on the pump experiment. The residents felt that the civil servants were withholding information. This and other elements, e.g., the feeling that the municipality does not have an integrated plan concerning the Bloemenbuurt and the financial consequences, complicated the trust relationship and slowed down the pace. In addition, the processes within the municipality are unclear for the residents. They mainly thought that they were fooled. Still, the participating residents in the GOP project experience that the civil servants generate distrust and negative energy with the residents. One of the interviewed residents shares that some of them were even advised by their doctor not to communicate with the municipality for a while.

Reflecting on trust, another interviewed resident refers to the construction errors he noticed with regard to the overflow pits on the Irisplein (did not work properly), the Violenstraat (not present), and the Orchideestraat (incorrectly dimensioned), see Figure 8. The civil servants showed up and asked him, ‘Who are you anyway?’ The resident describes that this created an uncomfortable situation. He continues sharing another incident during a mutual learning experiment in the adjacent Gravenbuurt. He bought some missing fittings, which were forgotten by the workmen to perform another experiment to increase the groundwater table. However, he could not claim the costs, he states. ‘No intervention helped and ultimately the civil servants did not talk about it anymore’, he said. To him the interpersonal relation with the involved civil servants was irreversibly damaged. Furthermore, he was not amused when he found out that the municipality passed on information to a third party without notifying the residents. It concerned pictures of the monitoring wells on the private property showing the gardens and houses.

The civil servants declare that they sensed very little trust and maybe even experience some distrust between them and the residents. Regarding benevolent-based trust the civil servant-process facilitator adds; ‘we are condemned to each other’. He sensed that the residents felt that they only received limited

information or not all the information they asked for. On the other hand, the civil servants sometimes exclaimed that the residents keep asking and it is never enough. Or that they did not know what the residents meant or wanted to know with certain questions. As stated above the civil servant-experts are not sufficiently skilled to ask the question behind the question.

However, the civil servants notify that in the GOP project, the residents threatened to escalate if they do not collaborate. ‘We are certainly not speeding up as a result,’ they say slightly indignant. One of the civil servant-experts remarks that he wants to learn together but 'local or policy interests' is given priority over 'knowledge sharing'. Moreover, he emphasizes that the Rotterdam municipality also adheres to the policy. The other civil servant-expert experiences that the mutual trust increased rapidly because, the residents recorded measurements which he found interesting. ‘We get together on the content’, he argues. He acknowledges that in the meantime he trusts the measurements of the residents. As a matter of fact, he and the residents worked both on determining the measurement processes and validating the data, he said. However, he admits that sometimes the level trust deflates.; ‘if we agree on something in the workgroup and it takes more time to settle the action, we sometimes forget to communicate about it. This way, the residents’ trust in the civil servants quickly ebbs away.’

Inquiry category 6: The components of power

Document study results

Albeit power is rather confusing and complex, we were able to highlight some aspects of power in the document dataset, as shown in Figure 8 in September 2016, March 2017, January, December 2019 and February 2020. For this study, power is defined according to the philosopher Foucault; the government knows its citizens, their needs, and therefore knows what to do, explained in paragraph 2.2.3 of this report. As far as this aspect of power concerns, the dataset suggests that the Alderman claims to understand the residents and that he will meet their requirements. However, his commitment to the active groundwater management experiment in the Bloemenbuurt subsequently creates extra tasks for civil servants. According to their position, they have to work in line with the policy. In which they also consider what is the best for all the citizens of the Rotterdam municipality, as underlined by governmentality. In this case, this concerns to establish 'no active groundwater management' as published in the Municipal Sewerage Plan-4 valid from 2016 - 2020 (Gemeentelijke Rioleringsplan-4, GRP4). This plan is reviewed every 5 years (Rotterdam municipality, 2021).

The pledge of the Alderman is issued because the residents had organised themselves and were aware of the political procedure of how to refute the standard of groundwater management by free decay in the Municipal Sewerage Plan-4. The sustainable development relevance concerning groundwater management pops up now and then, however, is underexposed in the document dataset. Considering, adequately managing this natural resource which is, in fact, no one’s property and thus a common good, is in many ways a complex task as mentioned by the civil servant-process facilitator above. We could not reveal in the document dataset to what extent power referring to Foucault's governmentality is applicable to our case study.

Interview and feedback questionnaire results

The interviewed residents notice that the civil servants were not comfortable when the organised residents escalated towards the City Council and the Aldermen. Albeit, they indicate that the residents dealt with this sparingly, referring to the actions in September 2016 and February 2020, as shown in Figure 8. However, in hindsight, the residents think they maybe should have been more proactive with this instrument. ‘They were at our side and it could have helped to speed up the process’, according to one of the residents. Hence, the residents perceive that the City Council understands its residents and listens to them.

The interview data showed us, that politics can overrule earlier settled policymaking. Unimpeded by any knowledge, they can act in favour of e.g., the voters. As a result, sometimes the residents force the local government to do something which the experts see as no good or not necessary. The civil servants have to deal with this whereby according to the residents, the civil servants understand the residents less. ‘However, if you do not like to work that way, do not become an official’, according to the civil servant-process facilitator.

To underline the statement that the civil servants do not understand the residents, they think that the civil servants do not care. 'None of the involved civil servants live in Rotterdam. They do not experience the consequences’, according to one of the interviewed residents. On the other side, the residents understand that the civil servants are busy. However, they were also wasting an enormous amount of time regarding the ‘motie pomp’ experiment discussion and the related policy conflict with the Municipality Sewage Plan, according to one of the interviewed residents.

In addition, another resident asked for and received a lot of information from the civil servants and workmen in the area (the eyes and ears in the field). When he learned more about the matter, he was told: 'it is better that you are not involved anymore'. He felt that the municipality wanted to do what they planned to do, which was to implement their policy without any interference e.g., the civil servants carried out the free decay implementation and tests without informing the residents, as shown in Figure 8. Hence, the obtained and shared local knowledge originated through Lived Experience fails to be included which can refer to strategic power play as defined by Tromp (2019).

Furthermore, the civil servants claim that they aspire to understand the needs of the residents, as explained by Foucault’s governmentality. On the other hand, they believe that the residents are strongly organised and that they escalate once they feel that there is no response given to their interests. ‘However, effective interventions are difficult. A lot of money is involved,’ one of the interviewed civil servants underpins. In the literature this is corroborated by Abbott & Wilson (2015) referring to the power of finance; the one who pays or fears for the financial consequences steers the process.

Moreover, this civil servant and his colleagues are regularly surprised by the articles and interviews about the Bloemenbuurt and the role of the municipality, via the media. He declares that he would like to be informed in advance. The interview data shows that the media is a trust element concerning an interviewed resident while a civil servant finds it a power component. Studying the datasets, it could also refer to the communication process and the transmission barrier of insufficient communication skills.

Inquiry category 7: The possible uptake to complement scientific knowledge considering the Lived Experience for Sustainable Water Management

Document study results

In relation to our central research question, we are interested to what extent the 3 determined types of local knowledge developed activities as mentioned above are taken into account and are relevant in the execution of the work, the uptake in urban policymaking, and how they can contribute to scientific knowledge development. The returning of the pumped groundwater via the DI system to the groundwater reservoir is a tangible example local knowledge originated through Lived Experience that has been directly incorporated into the execution, as shown Figure 8 in November 2016. However, if and how the monitoring wells measurements and the developed knowledge regarding 'motie pomp' are included in urban policymaking and could be relevant for scientific knowledge development, is not revealed in the document dataset and therefore studied the interviews.

Interview and feedback questionnaire results

Uptake of local knowledge in execution

All interviewees corroborate that the local knowledge developed via the monitoring wells measurements (I) is included in the engineering of the operational sewage work in the Bloemenbuurt. And as mentioned above, currently the residents are consulted upfront and during the performance of the work in the so-called sounding boards whereby they are the eyes and ears of the civil servants and also are the connection between the civil servant-experts and the implementation department of the Rotterdam municipality (II).

The civil servant-experts confirm that extra monitoring wells measurements and the field observations by residents were and still are very useful. The problems raised by the residents were studied and solved together and included in the execution of the projects ((I) and (II)). ‘We will apply this knowledge including local input of the residents in the next neighbourhood’, the civil servants add. They say that they intend to professionalise the analysis of the area before getting started. One of the civil servant-expert thinks about e.g., to include the impact of precipitation and evaporation in the area and to study the possibilities for water storage in the subsurface. The civil servant-process facilitator complements that he developed Lived Experience concerning building relationships and how to improve community involvement.

The side effect of this local learning process was that the civil servant-expert took over the management of the 2,000 monitoring wells in the public space in Rotterdam, since September 2019, see Figure 8. In our interview, he mentioned: ‘We took the plunge and adopted this activity from the Urban Management cluster. We started to measure via our field measuring services instead of via an external contractor. Furthermore, we planned to equip a quarter of the monitoring wells with automatic loggers by 2020’.

Uptake of local knowledge in urban policymaking

Concerning the residents, the proof of concept of active groundwater management originated through Lived Experience, is not included in urban policymaking. In addition, one of the interviewed residents declares that there is no 'free decay' at all because the Netherlands is a country famous for its water management. Phrases such as 'in harmony with nature' and the overall tone in the Municipal Sewerage Plan-5 valid from 2021 – 2025 (Gemeentelijk Rioleringsplan-5, GRP5) leave no room for active groundwater management in Rotterdam, he adds. From his perspective, this choice was made to secure the exception so that the Bloemenbuurt residents could move on. The other 2 residents agree. From their perspective, the developed local knowledge with the pump experiment conflicts with values and norms of the municipality i.e., this is the way we do things.

The interviewed civil servants were unable to answer this question straight away. They underline that active local groundwater management was not possible in the Municipality Sewage Plan-4. One of the interviewed civil servants declared that they are studying how to apply it in the GRP5. However, his colleague states that free decay is preferred in the recently published GRP5. Hence, if the situation deviates from this standard, another solution can and will be examined, he adds. This could be perceived as room for ‘action learning’ and uptake of local knowledge development including Lived Experience into urban policymaking. However, it demands more time, according to the respondents.

Uptake of local knowledge including Lived Experience in scientific knowledge development

The interviewed residents corroborate that they collected an amount of measurement data of the public and private monitoring wells in the Bloemenbuurt, since 2015, as shown in Figure 8. Since April 2016, the municipality and the residents exchange their measurement data. Over time, they reasoned concerning their results with the assistance of a dedicated software tool. In the course of 2020, the civil servant-expert and the involved residents validated the dataset of the residents and the municipality, see Annex III, the final evaluation report of the GOP project, Bloemenbuurt, Appendix 3 Validation of the monitoring wells measurements. This report was issued in February 2021, therefore not included in Figure 8.

Eventually these validated measurements based on input from local knowledge including Lived Experience can be important and thus imbedded in policymaking and even complement scientific knowledge development. Albeit, another interviewed resident is slightly more cautious with the statement that these so-called citizens science can complemented scientific knowledge development, the civil servants assert that collecting data by residents can be valuable for scientific knowledge development.

However, in the evaluation report of the GOP project explaining the validation of measurement data we could not find i.e., the agreed measurement method, and how to install and maintain the monitoring wells, as described in the manual of Bouma, Maasbommel & Schuurman (2012). Therefore, further research is required to define if this data including the methodology and maintenance will be valuable for scientific knowledge development. Herewith we indicate that collecting data to enrich the scientific knowledge development is possible, however it demands thorough and specific knowledge of the scientific subject and the skill how to construct new scientific knowledge.

5.3 Analysis of the research results

In Table 3 the analysis of the overall results of the document study and interviews are summarised per inquiry category of the determined assessment format. Studying the data, we learned that the feedback

questionnaire which was initially part of our research by means of triangulation of the semi-structured interviews also partly comply with the analysis of the overall research results, see Annex II, The Results of the Feedback Questionnaire.

Table 3. The analysis of the overall results of our case study per inquiry category.

nr	Inquiry category	Analysis of the overall research results
1	The cause for the (local) knowledge development for sustainability	Proximate influence (the reason, the cause) is not traced in the document data but is defined in the interview data. According to the interviewees, the proximate influence is groundwater management. However, in the invitation of the interview meeting, every interviewee could read that the case study concerned 'local knowledge and experience concerning sustainable water management, regarding the GOP project Bloemenbuurt'.
2	Action learning	Although not found in the document data, all interviewees confirm that they had an active role in the action learning process in developing local knowledge regarding groundwater management in the Bloemenbuurt. The participants gathered and exchanged information at the workgroup meetings enriched by learning through observations and Lived Experience in the field. Furthermore, some participants had contact via telephone calls and emails and they learned of these contact moments. Some interviewees stated that in the workgroup meetings the participants were explicitly reflecting, thinking, and acting. In some cases, the learning outcome was summarised by the residents, incorporated in a report, and published via local media. The data did not reveal a common agreement about how the mutual action learning process was structured. However, all the respondents clarified that they had an active role concerning the learning during the workgroup meetings and the bilateral contacts.
3	The local knowledge development types regarding LE_SWM	Regarding the local knowledge development elements, the 3 types of knowledge development originated through Lived Experience occurred in the document study, the Rotterdam Court of Audit report, and in the interview dataset. These are; I) initiative of the residents to measure monitoring wells in the public area and to install and measure the wells on private premises (citizens science); II) Lived Experience and experiences/observation of residents in the area (eyes and ears in the field); and III) development of local knowledge by joint experimenting.
4	Communication process	In the ex-post case study, the interview data reveals **3 barriers in the communication process**. First, **2 transmission barriers, being language use and insufficient communication skills**. The latter is defined as mismanagement of arrangements, not communicate about changes or delays, lack of preparation of the meetings, insufficient presentation skills, and lack of ability to ask further questions. And **one psychological barrier; cognitive dissonance**. The receiver understands the knowledge however, this is not consistent with the beliefs or values of the receiver.
5	Trust	The document data demonstrated that mainly the residents distrusted the civil servants. In the interviews, the respondents clarified that there was a **mutual feeling of the lack of benevolent trust**, which the residents called mistrust. Continually, the residents felt that the civil servants were withholding information. On the other hand, the civil servants did not understand the questions of the residents and wondered why they needed all that information. They did not trust the residents and realised that they would escalate if the civil servants did not collaborate and/or did not provide the required information. In addition, the **interpersonal trust between a resident and the Rotterdam municipality was irreversibly damaged**, by miserable and no-communication regarding some issues. Concerning the **competence-based trust, they appreciated each other's competencies** and efforts over time. During the interviews, the residents qualified the civil servants as experts, and the civil servants valued the 'eyes and ears in the field' of the residents.

Continuation of Table 3

nr	Inquiry category	Analysis of the overall research results
6	Power	What has been exposed in the data of document study concerning power defined by Foucault, is studied during the interviews. Hence, here the **civil servants show to act according to the Foucauldian governmentality approach**; they make policy in the general interest of all the residents in the Rotterdam municipality. They know what is best for their residents and underpin this in their interviews. In addition, the interview data unveiled that the 'knowing what the citizens need' element can also be viewed from another angle. Because, according to the residents, the City Council and the Aldermen understand them and know what they require by embracing 'motie pomp'. Via this escalation procedure of the organised residents, the politics overrule policy. Therefore, the **civil servants feel that the residents opt for a strategical power play**. In addition, **the residents experience the strategical power play of the civil servants** to participate in the pump experiment however still stoically implement the policy and do not involve the residents to compose the new Municipal Sewerage Plan-5.

7	The possible uptake of local knowledge to complement (scientific) knowledge development considering LE_SWM approach	In the document data, we disclosed local knowledge including Lived Experience in the execution work which was also corroborated in the Rotterdam Court of Audit Report 'Burgers of de Bres'. In the interview data, we established that the municipality amended execution work and technical urban development master plans including the results of the validated measurement data of the monitoring wells in combination with the observations in the field and Lived Experience of the residents. Concerning the uptake of local knowledge development in urban policymaking, we determined that the respondents and civil servants do not agree. The residents are persuasive that the developed local knowledge of the option of active groundwater management is not included in the Municipal Sewerage Plan-5. Notwithstanding, the civil servants are convinced that it is mentioned in the plan. However, groundwater management by free decay of surface water remains the standard in the GRP. The civil servant-experts and one resident argue that the uptake of new knowledge and insights into policy often takes time. Furthermore, both actor groups state that due to the validation of the monitoring wells measurements, mutual agreement on observations in the field, and Lived Experience, the developed local knowledge is interesting for scientific knowledge development for urban policymaking. However, while performing the ex-post case study the mutual validation on e.g., the agreed measuring method and maintenance of the monitoring wells cannot be fully detected in the data, and therefore it cannot be settled at this moment whether it can contribute to scientific knowledge development, see Annex III.

Chapter 6 Conclusions

We studied in our research if and how local knowledge including Lived Experience could complement scientific knowledge in urban policymaking regarding sustainable water management. The theoretical framework, the adapted concept, the assessment format, and the analysis of the data of the case study, answer the main research question in paragraph 6.1. Hereafter, the conclusions in detail regarding the sub-questions follow. In paragraph 6.2, we reflect on the trustworthiness, validity, applicability, consistency, and ethical aspects of our study.

6.1 Conclusions

This research aims to present empirical results and insights into the Lived Experience of climate change approach of Wilson (2012) adapted and applied for knowledge uptake from Lived Experience to complement scientific knowledge in urban policymaking regarding sustainable water management. This objective has led to the following research question:

How can knowledge uptake from Lived Experience complement scientific knowledge in urban policymaking regarding sustainable water management?

Through the theoretical framework and the conceptualisation of the Lived Experience of climate change holistic approach of Wilson et al. (2011), we learned in our case study that Lived Experience is something that residents of (mega)cities can possess. They are motivated by the fact that they are willing to improve their living environment to safeguard their homes. The residents want to be prepared for the unforeseen and are willing to share the obtained local knowledge including their Lived Experience of groundwater management with others.

The ex-post case study data corroborate that the learning process must be sufficiently organised, ordered, and facilitated as experiential learning is the basic building block of the applied theoretical

concept, see Figure 9. In addition, the learning must take place in a safe environment. Our study emphasise that action learning can support the dialogue in finding solutions originated through Lived Experience within a sustainable development planning process in a city (Kolb & Kolb, 2009; Wilson, 2012). Setting up an action learning process including an unambiguous objective requires customisation because as clarified by the interviewees, every neighbourhood has its own characteristics and thus its challenges which have to be aligned with the available Lived Experience (Frantzeskaki & Kabisch, 2016).

In our ex-post case study, we revealed that besides a structured and transparent action learning processes agreed by all actor groups, 3 barriers of the communication process must be kept in mind, for which we adopted the sender–receiver framework for knowledge transfer and uptake from Tromp (2019). We detected 2 transmission barriers; language use and communication skills and the psychological barrier 'receiver understand the knowledge, however it is not consistent with the beliefs of the receiver'. Furthermore, benevolent trust as being mutual trust in developing the right knowledge and the trust in sharing all knowledge, unveiled to be relevant to develop local knowledge including Lived Experience. Foucault's governmentality approach expounding that the State knows its residents seems to be the attitude of the civil servants. However, in our study, the positive power of governmentality is overruled by the escalation mechanism of the residents whereby politics go over policy. The strategic power play, explained by Tromp (2019) in the sender-receiver framework, by the residents and the civil servants hampers the developed local knowledge uptake.

Nonetheless, we unveiled 3 types of local knowledge development originated through Lived Experience. First, the Lived Experience obtained by performing measurements by the residents, in our case monitoring wells measurements concerning the groundwater tables. This can also be referred to as 'citizens science'. The second type is the residents' observations in the area combined with the local knowledge of the monitoring wells measurements. This is what the civil servants typify as the residents being their eyes and ears in the field. We conclude that this type of development of local knowledge including Lived Experience is encapsulated in the execution of the (sewage)work and the relevant technical urban development master plans in the city of Rotterdam. Furthermore, the residents are getting involved upfront in a sounding board when preparation of the execution of work starts. Nevertheless, the participants here also have to establish the mutual action learning process and to agree to what extent the mutually developed local knowledge including Lived Experience can complement execution of work and urban policymaking. And third, the mutual developed local knowledge including Lived Experience during joint experiments. However, our study did not determine that these 3 types of local knowledge development including Lived Experience qualify for inclusion in scientific knowledge development. Further study is required to clarify this part of our research question.

We summarise the findings regarding our theoretical concept in Figure 9. Subsequently, we will answer our sub-questions in detail below.

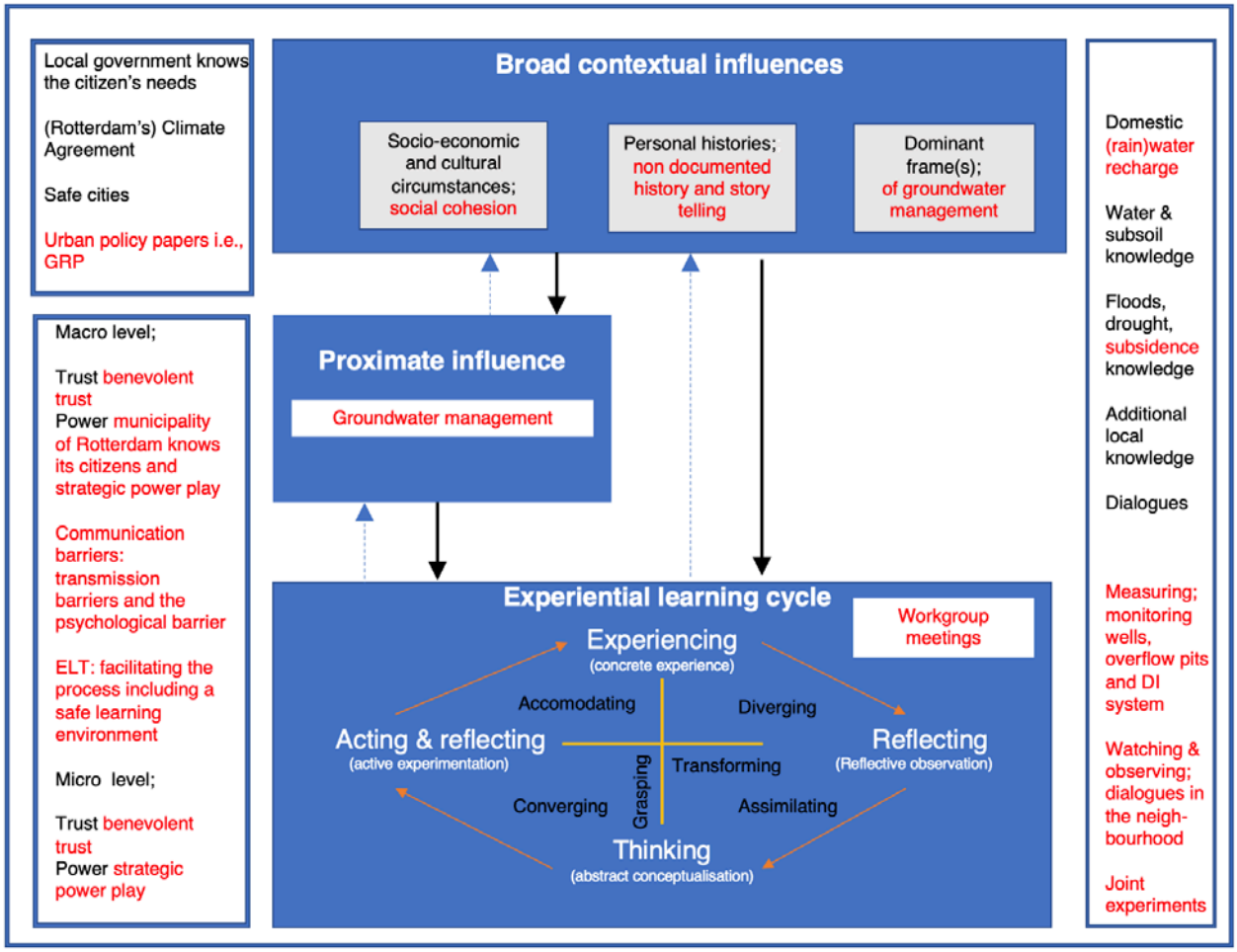

Figure 9. The GOP project Bloemenbuurt - groundwater programme Rotterdam-Hillegersberg, in the Netherlands case envisioned in the theoretical concept of Lived Experience knowledge uptake to complement scientific knowledge in urban policymaking regarding sustainable water management, including action learning and the effects of trust, power and local knowledge development adapted from Wilson et al. (Abbott & Wilson, 2015, p. 23; Pérez Salgado, Abbott & Wilson, 2018; Wilson 2012).

Sub-question 1. What is the definition of Lived Experience of citizens for sustainable water management measures in urban areas regarding action learning?

The experientially gained knowledge evolves partly through historical processes and storytelling of in our case study the residents and civil servant-experts. According to Abbott & Wilson (2015), local knowledge is a manifestation of Lived Experience (LE). They state that local knowledge may be proxy indicator for LE, however, should not be viewed as a synonym. As Fischer (2000) zooming in on local knowledge and participatory trajectories, Abbott & Wilson (2015) underline that local knowledge refers to indigenous technical knowledge rooted in practices of individuals or groups, and evolved locally over time (Abbott & Wilson, 2015, p. 107). However, upon the theoretical framework and our ex-post case study for the Rotterdam municipality we can substantiate local knowledge development originated through Lived Experience. We argue that it is not going beyond scientific knowledge. We reason that, residents who are living there for years are dedicated to sustain their living environment and possess a lot of local experiences which are valuable for the execution of work, policymaking, and eventually for science (Clark et al., 2016; Fischer, 2000; Frantzeskaki & Kabisch, 2016).

The Lived Experiential knowledge is considered to be legitimate when there is a mutual aim to construct new local knowledge including Lived Experience. Lived Experience has the potential to create an integrated knowledge through participatory processes (Abbott & Wilson, 2015, p. 121). Wilson (2012) explores in his Lived Experience holistic concept the occasion for groups to get together to elaborate about the way out of misery caused by climate change. We adapted this concept towards sustainable water management in an urban environment whereby new local knowledge is developed. The participants of the action learning process, described by Wilson (2012) are brought together because they have a common, acute problem. In our case study, lowering groundwater levels hence, groundwater management. They congregate in the workgroup meetings and stay in touch via bilateral contacts.

From this angle, the Lived Experience (LE) knowledge uptake to complement scientific knowledge in urban policymaking regarding sustainable water management adapted from the Lived Experience for climate change of Wilson (2012) is applied and unravel how participants learn collaboratively to develop local knowledge including LE and to take action to minimise the negative effects of in our case study too low groundwater levels. The residents want to move forward and obtain future-proof water management solutions (Brundtland, 1987; De Graaf & van der Brugge, 2010; Gleick, 2018; Hendriks, 2018; Wilson, 2012).

To zoom in on action learning being the basic building blocks of the Lived Experience for climate change holistic approach of Wilson (2012), the residents in our case study explained the action learning and include the Lived Experience by discussing the completeness and correctness of the possible solutions in the workgroup meetings. Upon the monitoring wells measurements, the local experiences of residents in the Bloemenbuurt and local and general water and subsoil knowledge questions were asked e.g., what information have we gathered, how are we going to interpret the information, and what more information and expertise and experience is needed? Furthermore, this ex-post holistic single case study unveiled that the residents learned by walking around while observing situations in the Bloemenbuurt and via dialoguing with the workers of the sewage work in the Bloemenbuurt. Finally, they also learned by reporting and discussing preferably per email with the civil servant-experts regarding the incorrect executions of the work affecting the groundwater level.

The civil servant-experts learned from the dialogues in the workgroup meetings including the discussions of the monitoring wells measurements, the observations of the residents (their eyes and ears) in the field, and the joint 'motie pomp' experiment. They also learned from the deliberations regarding the residents' observations in the field via emails. However, they view themselves as experts, which is underlined by Bosch, van der Greft & de Vries (2020). The civil servant-process facilitator corroborated that the participants learned and developed most of the knowledge in the workgroup meetings.

Kolb & Kolb (2009) underwrite that action learning clarifies learning as ‘the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience. Action learning as Kolb & Kolb (2009) studied in the Experiential Learning Theory has to be consciously planned and processed including the engaged actor groups. The residents were to a certain extent, aware of their learning process referring to some quotes in the documents and their explanation during the interviews. On the other hand, the Rotterdam municipality, also being the process facilitator, acknowledge that they have underestimated the effect of (mutual) action learning.

Furthermore, in our case study we observed that the Rotterdam municipality was not coherent in the facilitating process. As Barth et al. (2017) and Tromp (2019) analysed, various stakeholder groups must participate in a well-structured community learning process for sustainable development. They emphasise the relevance to organise the consultation structure and to explain the participants where there is an opportunity to learn from each other or to detect where the informal community learning takes place. Subsequently, the study of Bryant & Thomson (2020) underlines the process of organisational change towards sustainability within a local government and relates this to existing theories of change whereby learning can act as a key leverage point. They underline that the value and potential contribution of learning in sustainable transformations is underestimated. They conclude that learning experiences lead to internalisation of the skills and develop champions for, in our case sustainable water management within local government (Bryant & Thomson, 2020; Pérez Salgado, et al., 2018). Furthermore, De Graaf & van der Brugge (2010) substantiate that a strong and dedicated managing director facilitating this participatory learning approach is required. In our case study it occurs that on behalf of the Rotterdam municipality it is not transparent neither consistent who is in the lead of the groundwater programme Rotterdam. This observation also occurred in the study of Frantzeskaki & Kabisch (2016) and could endorse why the action learning process did not reach maturity and local knowledge development including Lived Experience was only partially picked up.

Sub-question 2. What communication process aspects can be identified for Lived Experience knowledge contributing to knowledge development and what are the effects of truth and power in the communication process?

According to Kolb & Kolb (2009) and Bryant & Thomson (2020), mutual learning requires the development of reciprocal understanding and therefore the communication is key. Abbott & Wilson (2015) and Tromp (2019) analysed the various barriers that hamper the communication process between sender and receiver and that result in limiting or even blocking the knowledge transfer and uptake. In the case study, we acknowledge 2 transmission barriers in the communication process regarding knowledge sharing, underpinned by Tromp (2019). The first barrier is not speaking the same language which in our case study directs to the incapacity to understand each other; asking the question behind the question, and avoiding bureaucratic jargon. Habermas (1984) argues that the fundamental form of coordination through a language requires speakers to adopt a practical stance oriented toward reaching mutual understanding, which he regards as the real and deeper meaning of speech. He states that when actors address one another with this practical attitude, they engage in what he calls communicative action (Habermas, 1984). Furthermore, he studies our ability to interact and communicate with each other, not just in the sense of conveying information, however, to justify our reflection in the form of discussion, debate and challenge (Wilson, 2012, pp. 20 - 21).

The second transmission barrier is insufficient communication skills, mentioned by the respondents as a lack of presentation skills and timely sharing of information by the Rotterdam municipality. This is also concluded in the Rotterdam Court of Audit report ‘Burgers op de Bres’ and can be addressed via training these skills (Bosch, van der Greft, & de Vries, 2020). The third barrier is a psychological barrier; the receiver understands the knowledge but is inconsistent with the beliefs or values of the receiver, thus

waiving the knowledge away. Cultural norms and values partake in the communication process. Collective emotions concerning lowering groundwater level usually centre around shared experiences of particular groups, meeting for mutual benefit to adapt or mitigate the threat of the discomforting circumstances (Abbott & Wilson, 2015, pp. 41 - 43). In the ex-post case study, this unsolved psychological barrier is unveiled by the continued lack of clarity concerning the 'motie pomp' experiment.

Regarding trust, the respondents exemplify that there was a mutual feeling of the lack of benevolent-trust, which the residents called mistrust (Tromp, 2019). Continually, the residents felt that the civil servants were withholding information which is also analysed in the Rotterdam Court of Audit report 'Burgers op de Bres' (Bosch, van der Greft, & de Vries, 2020). On the other hand, our case study revealed that the civil servants did not understand the questions of the residents and wondered why they needed all that information. They did not trust the residents and realised that they would escalate if the civil servants did not collaborate. In principle, the involved civil servant-expert also did not trust the monitoring wells measurements of the residents. Bryant & Thomson (2020), Kolb & Kolb (2009) and Fischer (2000) elucidate the importance of trust, psychological safety and genuine conversation in a learning environment. In addition, in our case study, the interpersonal trust between some of the participants was irreversibly damaged by miserable or no-communication regarding some issues.

Concerning the power components, we studied the Foucauldian philosophical concept of power to understand the technological win-wins in the productivity of power within local governmental organisations. Foucault questioned why the Western side of the globe insisted on seeing the power exercises as juridical and negative rather than technical and positive in the past. In addition, he discoursed that it is impossible to govern a State or local authority without knowing its population (Foucault & Gordon, 1980, pp. 119 - 121). This clarification of power he expounds as governmentality and is exposed by the working attitude and behaviour of the civil servant-experts in our ex-post case study. For the benefit of the common good, they define what is best for the Rotterdam municipality and its residents. Foucault's governmentality philosophical discussion is analysed by Wilson (2012) from the climate change perspective and the possible direct link to economic growth, concluding that it is gaining legitimacy for public policy and accommodating worries of residents (Wilson, 2012). However, we conclude that further research is needed to obtain more insights concerning governmentality as defined by Foucault applying action learning involving Lived Experience for sustainable development.

In addition, the strategic power play as a failure mechanism to uptake knowledge according to Tromp (2019), we conclude that the civil servants feel that the residents opt for strategical power play, e.g., by the escalation of the 'motie pomp' by the residents via the Alderman. The residents experience the strategical power play of the civil servants to participate in the pump-experiment, however, still stoically implement the policy and not involve the residents in drafting Municipal Sewerage Plan-5. When the civil servants hold on to the policy and the residents escalate to politics to overrule the policy, it is no longer a matter of learning or reasoning nor a clarification of power explained by Foucault.

Sub-question 3. How can action learning of citizens be detected and contribute to local knowledge development elements for sustainable water management in urban areas?

Upon the findings in literature and analysis of our case study we found 2 elements to detect action learning. First, following the line of reasoning of the Lived Experience of climate change holistic approach of Wilson et al. (2011) there must be mutual proximate influence (the reason, the cause) to start, as in our case study according to the residents and civil servants the deficient groundwater management. The collective emotions usually centre around shared experiences of a particular group, meeting for mutual benefit to adapt to the threat of discomforting circumstances (Abbott & Wilson, 2015).

Second, the actor groups must be willing to mutual action learning in which all parties and all knowledge including Lived Experience is accepted. According to Kolb & Kolb (2009), the residents must be invited to partake in the action learning, meaning the civil servant-process facilitator acts pro-active. In our case at the hindsight and in the ex-post situation, all respondents confirm that they had an active role in the learning process concerning the development of knowledge. However, we observed that the facilitation of the structure and the process between the residents and civil servant-experts was predominantly technical, not clearly defined, and not documented in an orderly and transparent manner. In addition, one resident interviewee adds that most of the meeting time the civil servant-experts explained why they hold on to the policy. The preparation, coordination, and the management of the emotions (free and safe place to operate with respect) during the gatherings as clarified by Barth et al. (2017) and endorsed by Bryant & Thomson (2020), De Graaf & van der Brugge (2010), Frantzeskaki & Kabisch (2016), and Tromp (2019) needs to be in place.

Sub-question 4. What could be a procedure to uptake the production of relevant Lived Experience knowledge into the urban policymaking process for sustainability?

To answer this sub-question, we return to the basis of our substantiated theoretical concept shown in Figure 9. The building blocks of the concept have been enriched with findings from our case study. This concept can assist the procedure to uptake the relevant Lived Experience into local knowlegde development for urban policymaking and to contribute to scientific knowledge development. It offers a clear picture at the start and can assist to transparency in the production of local knowledge originated through Lived Experience (Clark et al., 2016; De Graaf & van der Brugge, 2010; Fischer, 2000; Frantzeskaki & Kabisch, 2016; Leino & Peltomaa, 2012; Wilson, 2012). The 7 determined inquiry categories of the assessment format can be deployed as questions to design the process and localise the actor groups.

Eventually, with the results of the validated monitoring wells measurement data in combination with the observations and Lived Experience, the Rotterdam municipality by means of the civil servant-experts amended the execution work in the area and the master plans. As a result, they also introduced a sounding board with residents in the preparation and during the execution work in the area. Concerning the uptake of the developed local knowledge into urban policymaking, we determine that the respondents and civil servants do not agree. However, as stated by the respondents, the uptake of new knowledge and insights into urban policy often takes time.

On the other hand, both actor groups are convinced that due to the validation of the monitoring wells measurements, mutually agreed observations in the field, and Lived Experience the developed local

knowledge is interesting for scientific knowledge development for urban policymaking. During the interviews and studying appendix 3 of the final evaluation report of the GOP project, we conclude that the measurements were validated. However, e.g., the validation of the measurement method and the maintenance of the monitoring wells is not clarified by the data and requires further research.

6.2 Reflection on trustworthiness, validity, applicability, consistency and on ethical aspects

The objective of our study was to provide in-depth understanding of the phenomena Lived Experience for sustainable water management concept adapted from the Lived Experience holistic approach of Wilson et al. (2011) by identifying the relevance of local knowledge development through the Experiential Learning Theory (ELT) of Kolb. We applied the agreed qualitative mixed method research approach described in paragraph 4.2.3 and constructed the assessment framework regarding the 7 inquiry categories corresponding with theoretical framework.

Our qualitative research had 4 peculiar means to ensure the integrity and robustness of the data; i) trustworthiness, ii) validity, iii) applicability and iv) consistency (Hammarberg, Kirkman, & de Lacey, 2016; Verschuren & Doorewaard, 2016).

Concerning trustworthiness, we aimed to work as transparently as possible by discussing the purpose of the research, detailed discussion and description how each step of the mixed method, and why certain procedures were chosen (Hammarberg, Kirkman, & de Lacey, 2016). In retrospection we argue 5 decisions which could have impacted the trustworthiness of our approach. First, the ex-post case study goes back in time. Regarding the interviews, despite the semi-structuring, it was complicated to ask neutral questions, not to steer and to let the respondent talk. Second, we asked the expert key persons of the Rotterdam municipality, also the client for this research request, for all the available documents during the agreed timeline and we solely consulted the websites of the residents' groups regarding the same timeframe. The question is; did we obtain all available documents regarding our case study? Third, we determined the criteria to select the respondents of the interview, however, we only could make the group list by tracking names in the selected documents and the names of residents on the website. Therefore, the list of names could be incomplete. Fourth, the invitation to the interviewees was neutral however, in hindsight, considerably guiding. And the last one, the interviews were performed by the same interviewer on- and offline. During the interviews she was not supervised. The same interviewer supports continuity; however, it also can affect the trustworthiness of the research.

Regarding validity, the results are deemed to be believable. The techniques of the mixed method approach have been undertaken to ensure the validity of this case study including a 2-step triangulation (Robson, 2002, pp. 483 - 485). However, as discussed before, the selected documents were not composed for this research, the research period goes back in time and the interpretation of the project or programme is not unambiguous. Concerning this latter remark, in our document set and through the interviews we learned that the GOP project officially started in July 2017, while the Rotterdam Court of Audit report states that the GOP project started in 2012 (Bosch, van der Greft, & de Vries, 2020). Differentiation of the interpretation is human and therefore it can influence the validity of our research.

The criterion in qualitative research is the applicability or transferability of the research, which evaluates the external validity. This evaluates to what degree the results can be transferred to other contexts or is 'generalizable'. In this perspective, the sample size and the diversity of the interview study is discursive. To be able to gain transferable findings, the researcher has tried to gather sufficient validated data to reach data saturation regarding the determined research question. However, viewing the results we can conclude that it could be substantial situational (Hammarberg, Kirkman, & de Lacey, 2016; Verschuren & Doorewaard, 2016). Furthermore, we did not unveil the causality in our case study as discussed in figure 7. Therefore, additional research is required.

The criterion consistency defends the integrity of qualitative research. This is in our ex-post case study the synonym for reliability. However, as stated in paragraph 4.2.3, another interviewer applying the same semi-structured survey under the same conditions could retrieve other results. The researcher has tried to be consistent by comparing the data consequently in the different phases of the study via the determined assessment format based on scientific articles and literature. While, the results are summarised in a software programme, errors may occur as a result of e.g., by the lack of four-eyes principle concerning the data entry.

Furthermore, the mixed method produced an enormous amount of data in quite a small time-frame. Through the discussions with expert key persons, the documents they shared, and the reflection they gave on the interim report, relevant events situated over time became clearer, as shown in Figure 8. This and the methodology applied in the study of Tromp (2019) gave more insights how to structure the interviews. We had to restrict the number of interviews because of situation and time constrains. The researcher obtained the data and experienced the emotions during the face-to-face interviews that would not have become clear with solely a paper-based survey. As one of the interviewees argued that the feedback questionnaire which was applied for triangulation, did not leave room for nuances. These emotions were recorded in the concept interview reports. The concept report was approved by the interviewee and coded afterwards for retrieving the interview results. For further research, we will file the 49 selected documents, the 6 confirmed interview reports, the filled in assessment format of the document study and the interviews, the email invitation for the interviews, the semi-structured interview format, and the feedback questionnaire.

Continuing to our ethical considerations, we sincerely considered the 'right to know' and 'right to privacy, dignity and self-determination' of the research participants being the practical experts, key persons and the interviewees. We guarantee the anonymity of interviewees and the actors mentioned in de studied documents. However, we mark for obvious reasons that it is impossible to grant the anonymity of public personalities i.e., Aldermen and City Council members. Notwithstanding, the confidential information e.g., actor code, male/female, age and number of months involved with the groundwater programme Rotterdam-Hillegersberg will be stored and safekept at the OU and excluded in the public reports or annexes.

The contact person of the municipality of Rotterdam invited the interviewees to partake in this research. In the invitation, which was the same for everyone, he underlined the independence of the researcher. The interviewees participated voluntarily without remuneration. The civil servants were interviewed during working hours. There was no hierarchical relation between the actors mentioned in the documents neither with the interviewees regarding the researcher. The research has been conducted for a master thesis. The research process including the publication of the research report is respected by the client and participants. No commercial, financial or political interest has been exerted in the performance of the investigation.

Chapter 7 Discussion

In the discussion, we first consider the relevance of our findings for science. Subsequently, we look at the relevance of the applied methodology and we conclude with the relevance from a general and societal perspective. Furthermore, we list the limitations of the research approach and suggest additional further research.

7.1 Relevance of the results

Relevance of the results for science

Wilson et al. (2011) introduced the Lived Experience of climate change holistic approach including mutual action learning. They clarified the wealth of narratives, local experiences, and local knowledge within communities to develop area-specific knowledge. In addition, Leino & Peltomaa (2012) studied how situated knowledge produced by citizens affects the construction and understanding of legitimacy in local environmental governance. They underline that knowledge is strongly connected with action and in addition also interconnected with many networks. Therefore, knowledge is dynamic, unstable and does not necessarily easily settle into any pre-given categories. They argue how this citizen-based knowledge; experimental, experiences, or empirical, can be integrated into processes that are orchestrated in the different stages of multi-level governance. They state that knowers are situated in time and place. The knowledge these knowers establish bears their historical stories which are relevant to their construction of knowledge. To collaborate with others on a daily basis, the knowers tend to make sense of new information in terms that relate to what they already know. Consequently, focusing on the processes of situational knowledge and legitimacy did not only change the context of participatory practices. It has also improved the processes to be more credible and grounded from the citizens' viewpoint, according to their findings (Leino & Peltomaa, 2012). Therefore, development of situated knowledge is an interesting observation for local knowledge including Lived Experience.

However, they revealed that the construction of such a local knowledge seemed to be ongoing process by a multitude of actors and hence difficult to structure. Consistent with Clark et al. (2016), they underline that some knowledge bubbles up through the entrepreneurship and curiosity of local people with hardly or no formal research training. Both studies state that multiple sources of knowledge must meet for sustainable development. However, they argue that have to be detected what can be done to improve the collection of this kind of knowledge. Clark et al. (2016) and Leino & Peltomaa (2012) both concurs with

Abbott & Wilson (2015) clarification that it is up to science to do whatever is required with the Lived Experience knowledge collection. In addition, Abbott & Wilson (2015) even state that this way of scientific knowledge development could be insufficiently structured and scrutinized. Therefore, it could be set aside. Our ex-post case study neither underpinned that Lived Experience could complement scientific knowledge development at this stage. Albeit, mutual learning originated through Lived Experience is achieved, it underlined the difficulties and complexity of the scientific knowledge development process. Further research is required to unveil if and how developed local knowledge originated through Lived Experience can complement scientific knowledge.

Elaborating on the different stages of multi-level governance, De Graaf & van der Brugge (2010) and Frantzeskaki & Kabisch (2016) explain in their studies the fragmentation of water management responsibilities within the Rotterdam municipality. In addition, Bryant & Thomson (2020) emphases the importance that learning, being a key leverage point for sustainability transformations within local governments, is undervalued. They defined the preconditions whereof one was the education programme underlining the importance of mutual understanding (language), trust, and respect. Furthermore, officials should meet and collaborate on cross-disciplinary sustainability projects (Bryant & Thomson, 2020). Pérez, et al. (2014, 2018) underpin these and other relevant skills and competences of practitioners to accelerate sustainable development can be learned off- and online. Regarding our case study we detected 2 elements being the language use and insufficient communication skills of the civil servant-experts acting as transmission barriers in the communication process that hampered the mutual action learning process. However, further research is required to what extent learning is a key leverage point and how to improve the practitioner's skills for sustainable development.

The study of Tromp (2019), focussing on the sender – receiver process for knowledge transfer and – uptake, gave insights in the complexity of the barriers and failure mechanisms in the communication process including trust and power. She involved citizens and other relevant actors in her research. Even though Barth et al. (2017), De Graaf & van de Brugge (2010), and Frantzeskaki & Kabisch (2016) did not demand citizens in the mutual learning process for sustainable development, their studies also refer a structured and mandated 'knowledge co-production operating space'. Tromp (2019) summarises that the chains in a knowledge transfer process are designable, however, complex. In our case study, we unveiled that the workgroup meetings, bilaterals in the field, and correspondence via emails can be considered as 'knowledge co-production operating spaces'. However, our case study is performed ex-post. Albeit, all interviewees agreed that they mutually learned in the determined 'operating spaces', it was not designed as in the studies of Barth et al. (2017), De Graaf & van de Brugge (2010), Frantzeskaki & Kabisch (2016) and Tromp (2020).

Furthermore, we observed in our ex-post case study that scientific research of power relations is a challenging one. Tromp (2019) refers in her study to strategic power play regarding knowledge uptake which we revealed in our case study. As Wilson (2012) we also studied governmentality explained by Foucault. In retrospect, we detected signs of the civil servants knowing what the citizens need which could refer to governmentality. However, this could be from the perspective of authority instead of a positive

attitude to take care of the residents. Following the line of reasoning of Morrison et al. (2019), the City Council plus the Aldermen are one of the actor groups. According to the residents, they understand the residents and know what they want. This also does not per se fit the governmentality explanation of Foucault. Most probably it suits the pragmatic power of the City Council conceivable in combination with framing power of the residents as being a lobbyist group. One of the other actor groups, the civil servants who have to execute the agreed policy are performing the power by design. However, in our case study, it seems that pragmatic power and/or framing power (politics) overrule power by design (policy). As Morrison et al. (2019) clarified in a polycentric system, which also applies to Rotterdam municipality according to Hendriks (2006), it is a different observation angle of the power component and requires further research.

In addition, De Graaf & van der Brugge (2010) underlined that at the beginning of this Millennium the fragmentation of water management responsibilities within the Rotterdam municipality did not encourage the possible social side effects of water in the urban environment. As Frantzeskaki & Kabisch (2016), they studied the effect of the co-production with practitioners in various fields of expertise to improve the sustainability of the living environment. They unveiled the leverage effect of inclusiveness of the co-production. Furthermore, they detected the increased accountability and applicability of the involved stakeholders. Albeit, they have not included citizens directly in their studies, the residents interviewed in our case study refer to their interest in inclusiveness and improving social cohesion related to sustainable groundwater management solutions in their area. However, to what extent and for whom, is a topic to be addressed for further research.

Relevance of the applied method

Up to and until 2010 the reconnaissance of climate change was predominately a study of natural sciences. Over the past decade, social sciences have highlighted the human and social dimensions of climate change and underlined the relevance of the interdisciplinarity approach. Fischer (2000) shows that qualitative social sciences mixed methods studies revealed new and creative insights to complement natural sciences in the process of how to mitigate or to adapt to climate change. Abbott & Wilson (2015) advocate an interdisciplinary approach that draws on disciplinary interfaces and grounds itself amongst others in everyday Lived Experience. In our study, we opt for multi-disciplinarity; social and natural sciences, and cross-overs with communication, law, and public administration. Furthermore, there can be a trans-disciplinarity among these disciplines. However, some scientists and policymakers carry on focusing on their field of expertise. With that said, there is no right or wrong between these two lines of reasoning however, it does not do any harm to be aware of both.

Relevance of the results in general and for society

The general relevance of our research overlaps the overall purpose of the study and meets the commission of our client. As we articulated in paragraph 2.1, enforced by rules and regulations, public authorities in the Netherlands, have to involve citizens and communities for sustainable development regarding spatial planning in urbanisations, rural areas, and public spaces. This is anchored in today's

Multi-Year Programme for Infrastructure, Spatial Planning and Transport, abbreviated in Dutch as MIRT (Meerjarenprogramma Infrastructuur, Ruimte en Transport) (Ministry of Infrastructure and Water Management, n.d.). Although, tools are developed and the exchange of implementation experiences is facilitated, it remains difficult to be successful in this area of expertise. Therefore, we studied the adapted concept of local knowledge development originated through Lived Experience of residents, for urban policymaking to accelerate sustainable water management.

The results of the case study contribute to the public debate on how to genuinely include residents to construct local knowledge including their Lived Experience achieving sustainable development of their living environment for now and generations to come (Brundtland, 1987). Frantzeskaki & Kabisch (2016) underline that sustainable urban development will be required and ask for a combined effort of different scientific disciplines. The emerging awareness of interlinkages between human and ecological systems calls for new approaches to knowledge production. In addition, it also needs an active dialogue between stakeholders from policy, science and society. In addition, Leino & Peltomaa (2012) revealed in their study that the style of action reported in the media may either increase or diminish the situational authority of an actor. Media was mentioned in our case study referring to trust and power as components in the communication process. However, the extent of effect of media underlined by Leino & Peltomaa (2012) is underexposed in our case and interesting for further research.

Furthermore, Fischer (2000) acknowledges, that albeit citizens participation is often quite difficult to implement in practice because it is not a straightforward ‘one size fits all’ for environmental issues, it can be a critical component. Particularly when local knowledge of citizens is applied to augment and even direct the research of practitioners. Therefore, he prefers to refer to practitioners instead of experts, which we in retrospect of our study underline. Fischer argues a participation process, referring to public learning can restore the understanding and trust between practitioners and citizens. The liberal democracy and a sustainable environment both will prosper with such an approach (Fischer, 2000).

7.2 Limitations of this scientific research

The first limitation is that it concerns explorative qualitative research of an environmental issue influenced by an administrative perspective that is still relevant today. Therefore, the researcher has to safeguard the independency and be extra alert regarding objectivity. It is important to be aware of this and reflect with supervisors and peers on a regular basis during the research (Baxter & Jack, 2008).
This links to the second limitation of our research not considering the administration of the Rotterdam municipality changes every 4 years and the effect of the other involved residents' groups in the foundation-risk area Hillegersberg. Our research is nailed towards mutual experiential learning, local knowledge development originated through Lived Experience concerning sustainable (ground)water management in the Bloemenbuurt.

The third limitation is that we performed this single case study which unveiled the first insights of the adapted concept of Lived Experience to complement scientific knowledge in urban policymaking regarding sustainable water management. To develop a better understanding of the obtained findings we should perform further research, e.g., an in-depth group interview with the respondents discussing the differences between the individual outcome of the interviews, a workshop concerning monitoring wells measurement methods with the residents and civil servant-practitioners and an in-depth interview with the researchers of the Rotterdam Court of Audit Report to discourse the differences between their findings and the findings of our case study. However, the COVID-19 pandemic outbreak lockdown regulations restricted our research possibilities (Baarda, 2014; Verschuren & Doorewaard, 2016).

Chapter 8 Recommendations

This research is explorative in nature and might lead to new additional elements of the development of local knowledge originated through Lived Experience in the holistic approach concept applied to sustainable (ground)water management. The constructed and underpinned insights of our research are valid however incomplete. Notwithstanding, we would like to offer directions for further research and give recommendations for the Rotterdam municipality and its residents.

8.1 Recommendations for future scientific research

We are aware that we were in a privileged position to direct our research questions. However, the ex-post case study has its limitations, as described in paragraph 7.2. Next to the proposed further research discussed above, we recommend further data collection and analysis on this case study regarding the Experiential Learning Theory in real time. It is interesting to observe the learning processes and the communication barriers during the workgroup meetings and see how the participants act during the contact moments. Additionally, the other barriers to transfer knowledge and the failure mechanisms to uptake knowledge in the communication process and the trust and power elements regarding developing local knowledge including Lived Experience for sustainable water management concerning other cases could be of interest for science.

For the purpose of our study, the demarcation of the location was necessary. The Bloemenbuurt seemed to be the best-reasoned delineation. However, groundwater does not recognise borders. Therefore, we would like to recommend stretching the analysis towards a broader area and observe the effect of the participation of more resident groups.

Furthermore, it is interesting to learn i.e., via workshops, how the next steps can be taken to make the developed local knowledge originated through Lived Experience of the validated monitoring wells measurements of added value to complement scientific knowledge.

In addition, Abbott & Wilson (2015) also referred to the power of finance, the one who pays or fears for the financial consequences steers the process. This was also mentioned by the interviewees and underexposed in our ex-post case study. However, this might be of interest for further research.

8.2 Recommendations for civil servant-experts & -process facilitators

The recommendations for the employees of the Rotterdam municipality are of more a practical nature and can be implemented as interventions for the next phase of the groundwater programme Rotterdam-Hillegersberg, in the Netherlands. First, referring to the heart of the applied concept being mutual action learning we would like to recommend an objective process to collect feedback during and after the workgroup meetings to learn from each meeting concerning attitude and behaviour of the participants, and how to adapt in order to obtain sincere involvement of the residents and collect local knowledge originated through Lived Experience (Kolb & Kolb, 2009; Tromp, 2019; Wilson, 2012).

Second, learning is by far a process of social negotiation for which dialogue is crucial. Speaking the same language and agreeing on the pace is relevant. Furthermore, an open and transparent atmosphere is a must-have pre-condition that must be respected by all participants. Each participant should be positioned at the same level, and any form of hierarchy should be avoided. Therefore, it is recommended to map the situation with care and analyse the actors including their roles. In addition, act in compliance with the mapping, in the dialogues and meetings. This could help to run more smoothly the learning and the discussions (Barth et al., 2017; Fischer, 2000).

Third, to eliminate the transmission barriers; train how to get better prepared for meetings, how to learn to speak the same language, improve the project administration i.e., provide an action – and decision list, and to improve presentation skills. In addition, the studies of Bryant & Thomson (2020) and Perez, Abbott & Wilson (2018) show insights concerning the importance of learning and professional competencies for interventions towards sustainability whereby intrinsic motivation of the practitioners is key.

Fourth, to increase the level of trustworthiness and transparency of the process, learn how to mediate and negotiate what can and cannot be done (Tromp, 2019). As one of the residents mentioned during the interview, be clear that it is an experiment and not a decision yet; be decisive about the local knowledge development process and the political procedures. In other words, have an appropriate and joint programme structure with a clear process and up-to-date action - and decision list. And finally, we would like to share an intervention proposal of one of the interviewed residents; ‘perhaps the civil servants can now and then give a compliment to helpful citizens’.

8.3 Recommendations for residents

As the recommendations for the civil servants, that of the residents is also practical. In our case study, the residents learned a lot and became somewhat frustrated that they were not fully involved and informed. They were and still are very active and it would be a missed opportunity for both actor groups that this amount of willingness to learn, share knowledge and develop local knowledge would dissipate. With the outcome of this research, we would like to recommend restarting the dialogue to design a mutually agreed action learning process and streamline the communication. Including an agreed mediating mechanism when consensus is out of focus or even out of reach. In the end, we all benefit when we can include local knowledge originated by Lived Experience in urban policymaking for sustainable water management. After all, it is our common future (Brundtland, 1987).

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AD
Rotterdams Dagblad

woensdag 6 juli 2016

Astma-centrum in Davos staat ter discussie. Te duur en twijfel of het werkt. ▸ P3

Frank en zijn Melissa trouwen in kraamkamer van ziekenhuis. ▸ P7

Frank de Boer gaat weer op zijn tweelingbroer Ronald lijken. ▸ P20

▸ **Hulp voor arme huiseigenaar**

Fonds voor reparatie bij paalrot

Huiseigenaren die de fundering moeten vervangen vanwege paalrot, kunnen binnenkort een beroep doen op een speciaal fonds.

Deborah Jongejan
Den Haag

In dit fonds komt 100 miljoen euro, waarmee honderden huizenblokken kunnen worden opgeknapt. Dat schrijft minister Stef Blok van Wonen aan de Tweede Kamer. Het kabinet stort zelf 20 miljoen euro in het fonds.

Gemeenten en banken moeten dat aanvullen tot 100 miljoen euro. Daarmee kunnen zo'n 2.000 leningen worden verstrekt. Het is de bedoeling dat het fonds per 1 januari 2017 van start gaat.

Huizenblokken met paalrot moeten in één keer worden aangepakt, een kostbare en complexe klus. Als één van de bewoners in het rijtje daar geen geld voor heeft, kan de fundering in zijn geheel niet worden hersteld. Het geld is bedoeld om dat nijpende probleem aan te pakken.

Huiseigenaren kunnen bij het fonds een op maat gesneden lening krijgen met gunstigere voorwaarden, zoals een lage rente. Het gaat om huizenbezitters met 'urgente funderingsproblemen', waarvoor binnen vijf jaar herstel nodig is.

De Tweede Kamer had hier op initiatief van PvdA, VVD en ChristenUnie om gevraagd. Het geld komt uit een onbenut potje dat bedoeld was voor energiebesparende maatregelen voor appartementen. De Kamer heeft als voorwaarde gesteld dat behalve herstel van de fundering, ook meteen de vloeren extra geïsoleerd moeten worden.

Paalrot ontstaat als het grondwaterpeil zakt. Houten palen staan daardoor niet meer onder water, waardoor schimmels vrij spel hebben. Hierdoor kunnen huizen verzakken of kunnen er scheuren ontstaan. Het probleem speelt vooral in Dordrecht, Gouda, Rotterdam, Schiedam, Zaanstad en delen van Friesland.

Laurens rea

ROTTERDAM Drie zorgorgani
ties in de regio Rijnmond staan
de top 11 van instellingen die
kampen hebben met grote prob
men in hun verpleeghuizen.
Careyn, Laurens en Humanitas
zorg niet op orde brengen, dre

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